

SECTION C FMT/MTU OFFLINE AND ONLINE DIAGNOSTICS

C.1 Introduction

This section provides offline and online diagnostic routines for the Magnetic Tape System (MTS). The section is organized into four main topics:

- (1) A listing of routine numbers, names, and execution times.
- (2) Procedures for initiating and terminating offline or online routines.
- (3) A listing of error codes resulting from malfunctions encountered during performance of a routine together with the probable cause of the malfunction.
- (4) A detailed description of each routine.

The diagnostics are a maintenance tool to determine if the MTS is operating properly. If a fault exists, the operations will stop and the operator can use a field tester to determine the error code. A description of the error and the most probable cause(s) of the error are listed with the error code number. The user can then either replace that item or implement other tests associated with that item.

Example:

<u>Routine</u>	<u>Error</u> <u>code</u>	<u>Description</u>	<u>Fault location</u>
54	32	MTU capstan motor abnormal	Capstan motor assembly

The user can either replace the capstan motor assembly or test the capstan motor using L0130.

In other cases that require replacement of a printed circuit assembly (PCA), refer to the PCA location charts. (A tab is provided for quick reference to the PCA location charts.)

Offline and online diagnostics are similar to one another in that most routines are the same. However, execution times (run times) may differ.

C.2 Offline Diagnostics

Offline diagnostics are performed with the field tester. Table C.1 lists offline diagnostics routine numbers, names, and execution times. More detailed descriptions of routines are provided in the last part of FMT/MTU Diagnostics (see Section C.5).

If an illegal routine is attempted during diagnostics, no test routine will be performed, and the routine indicator will display 00. An illegal routine is defined as any offline diagnostics routine number that does not appear in Table C.1, below.

Offline diagnostics self-test programs for the FMT and MTU are stored in an FMT microprogram. The following conditions are required:

- (1) The operator should be familiar with the field tester (see Part I of this Maintenance Manual for a description of the field tester).
- (2) The MTU to be tested must be selected and placed in an online status.
- (3) A full reel of good-quality work tape (SRM 3200 or equivalent) with a file-protect ring must be used.
- (4) If interface cables between an FMT and controller are connected, the host controller power should be turned off.

Routines 80, 83 and 90 through 98 are utility programs. These routines have unique requirements and conditions for the tape used during execution. Refer to Section C.5 for those requirements and conditions.

Table C.1 Summary of offline diagnostics routines

Routine number	Routine name	Maximum execution times
A8	Test all diagnostics routines	5 to 6 minutes
10	Microprocessor self diagnostics	1.6 seconds
11	LSR test partial	1.6 seconds
12	Local memory read/write test	1.6 seconds
14	External register write and sense bus test	1.6 seconds
15	Timer function test	1.6 seconds
20	Diagnostics program of controller interface printed circuit assembly PCA 1	1.6 seconds
21	Diagnostics program of controller interface printed circuit assembly 2	1.6 seconds
22	Diagnostics program of tape unit interface printed circuit assembly	1.6 seconds
23	Routine to confirm MTU selection	1.6 seconds
24	FMT-MTU data bus test	1.6 seconds
25	Tacho pulse signal test	1.6 seconds
26	Tape speed detection circuit test	1.6 seconds
28	Repositioning counter and counter control test	1.6 seconds
29	Trap circuit test	5.0 seconds
30	FMT LSI scan test	1.6 seconds
31	Time sensor and decoder test	2.2 seconds
32	Loop write/read (LWR) FMT phase encoded format	1.6 seconds
33	Loop write/read (LWR) FMT group coded recording	1.6 seconds
34	Loop write/read FMT nonreturn to zero I (NRZI)	1.8 seconds
35	Loop write/read TU IF (tape unit interface) phase encode	1.6 seconds
36	Loop write/read TU IF group coded recording	1.6 seconds
37	Loop write/read TU IF nonreturn to zero I	1.8 seconds
38	Loop write/read R/W phase encode	3.4 seconds

Table C.1 Summary of offline diagnostics routines (continued)

Routine number	Routine name	Maximum execution times	
39	Loop write/read R/W group coded recording	4.2	seconds
40	Error correction logic phase encode	2.6	seconds
41	Group coded recording 1 track correction test	1.9	seconds
42	Group coded recording 2 track correction test	1.8	seconds
43	Group coded recording 3 track mask test	1.6	seconds
44	Phase error pointer test	2.3	seconds
45	Nonreturn to zero I correction test	2.6	seconds
46	FMT control circuit test	1.7	seconds
50	Reel servo test (simple turn)	8.6	seconds
51	Reel servo margin test	9 to 31	seconds
52	Capstan simple running test	13 to 27	seconds
53	Write current on test	3	seconds (a)
54	Auto cleaner test	14	seconds
55	Capstan servo margin test 1600 rows per inch write	38 to 43	seconds
56	Capstan servo margin test 1600 rows per inch forward and backward read	1.1 to 15	minutes
57	Capstan servo margin test 6250 rows per inch write	24 to 36	seconds
58	Capstan servo margin test 6250 rows per inch forward and backward read	26 to 38	seconds
60	Erase effect test	7.3	seconds
61	Self amplitude gain control circuit test	7.4	seconds (a)
62	Group coded recording normal write test	7.5	seconds (b)
63	Phase Encode normal write test	8	seconds (b)
64	Nonreturn to zero I normal write test	7.9	seconds (b)
65	Slice margin and read level test	6.4	seconds (b)
66	IBG (Inter block gap) length check test	15.1	seconds (b)
70	Feed through test	7.3	seconds (b)
71	Cross talk test	6.9	seconds (b)
73	Phase Encode total read and write test	11.1	seconds (b)
74	Group coded recording total read and write test	10.3	seconds (b)
75	Non return to zero I total read and write test	9.3	seconds (b)
79	Special routine to test ready status	1.6	seconds
80	Test program for installation check out of azimuth and capstan alignment	--	
83	Test program for conversion check out of read amplifier	8.8	seconds

(a) Execution time may be increased up to 12 seconds depending on tape quality.

(b) Execution time may be increased up to 50 seconds depending on tape quality.

Table C.1 Summary of offline diagnostics routines (continued)

Routine number	Routine name	Maximum execution times
90	Tape retention action utility	1.6 seconds
91	Data security erase and rewind utility	--
92	Read check to tape mark	--
93	Group coded recording write running utility	--
94	Phase Encode write running utility	--
95	Nonreturn to zero I write running utility	--
96	Back space to beginning of tape	--
97	Space to end of tape	--

C.2.1 Performing offline diagnostics

There are three different methods of performing offline diagnostics:

Method 1: Offline diagnostics using MTU #0

Method 2: Offline diagnostics using MTU #1 (through #7)

Method 3: Offline diagnostics using the individual routines listed in Section C.5.

In all cases, the following conditions are required to perform offline diagnostics:

- (1) The MTU to be tested must be selected and placed in an online status.
- (2) A full reel of good-quality work tape (SRM 3200 or equivalent) with a file-protect ring must be used.
- (3) If interface cables between a FMT and controller are connected, the host controller power should be turned off.

Method 1: Offline Diagnostics Using MTU #0

- (1) Connect the field tester (refer to Part I, CONNECTION OF FIELD TESTER TO FMT).
- (2) Set the ONL/OFL switch on field tester front panel to OFL.
- (3) Set the field tester switches S0 through S7 to \$A8 and toggle the CNT switch to initiate diagnostics routine.
- (4) Set the field tester switches S0 through S7 to \$80. Lamp L1 on the field tester will go on. When the diagnostic routine terminates or is complete, lamp L1 will go off. Check lamps L8 and L11. If they are off, no error exists. The diagnostics are complete.

- (5) If either lamp L8 or L11 is on, set the field tester switches to \$35 and toggle the CNT switch. This will display the routine number.
- (6) Set the field tester switches to \$36 to display the error code.
- (7) Refer to Section C for a description of routine numbers and error codes. Refer to Section C.4 for corrective actions.

Method 2: Offline Diagnostics Using MTU #1 through #7

- (1) Connect the field tester (refer to Part I CONNECTION OF FIELD TESTER TO FMT).
- (2) Set the ONL/OFL switch on field tester front panel to OFL.
- (3) Set field tester switches to \$B2 and toggle the CNT switch.
- (4) Set field tester switches to \$01 and toggle the SSS switch. (Use \$02 for MTU #2, \$03 for MTU #3, etc.)
- (5) Set field tester switches to \$3E and toggle the SSS switch.
- (6) Set the field tester switches S0 through S7 to \$A8 and toggle the CNT switch to initiate diagnostics routine.
- (7) Set the field tester switches S0 through S7 to \$80. Lamp L1 on the field tester will go on. When the diagnostic routine terminates or is complete, lamp L1 on the field tester will go off. Check lamps L8 and L11. If they are off, no error exists. The diagnostics are complete.
- (8) If either lamp L8 or L11 is on, set the field tester switches to \$35 and toggle the CNT switch. This will display the routine number.
- (9) Set the field tester switches to \$36 to display the error code.
- (10) Refer to Section C for a description of routine numbers and error codes. Refer to Section C.4 for corrective actions.

Method 3: Offline Diagnostics Using the Individual Routines Listed in Section C.5

Table C.1, Section C in this Maintenance Manual, is a list of offline diagnostics that can be performed with the field tester. This table lists all offline diagnostics routine numbers, names, and execution times. A more detailed description of the routines themselves are provided in Section C.5.

Follow these steps to initiate offline diagnostics routines:

- (1) Connect the field tester (refer to Part I CONNECTION OF FIELD TESTER TO FMT).

- (2) Set the ONL/OFL switch on field tester front panel to OFL.
- (3) Set field tester switches 0 through 7 to \$B2, and then toggle the CNT switch.
- (4) Set the field tester switches 0 through 7 to the routine number desired (\$XX), and then toggle the SSS switch. (See Table C.1 for routine numbers.)
- (5) Set switches to \$39 and toggle the SSS switch.
- (6) Set switches to \$B2 and toggle the CNT switch.
- (7) Set switches to \$XY and toggle the SSS switch. (Use \$01 for MTU #1, etc.)
- (8) Set switches to \$3E and toggle the SSS switch.
- (9) Set switches to \$A8 and toggle the CNT switch to start offline diagnostic routine.
- (10) Set switches to \$80 to set interface display mode.

Note: Steps 6-8 are not necessary if working with MTU \$00.

While an offline diagnostic program is in progress, indicator lamp L1 on the field tester front panel remains on (lit). When the offline diagnostic is completed or is terminated for any reason and errors have been detected, lamp L8 will be lit. The routine number for which the error was detected is stored in a FMT register. The error code is also stored. The error code and associated routine number can be accessed by the field tester to evaluate the error. (Corrective actions are described in Section C.4.)

C.3 Online Diagnostics

Online diagnostics can be initiated using a "start-test" command from the host/controller or by issuing \$01 from the field tester (see C.3.1). A summary of the routine numbers, names, and execution times is listed in Table C.2. All tests are run automatically when Test Magnetic Tape System (TMTS) is issued from the controller. TMTS is also commonly shown as Routine 01 and "start test."

Note that the routines and error codes for online diagnostics are identical to those for offline diagnostics except for execution times.

Table C.2 Summary of online diagnostic routines

Routine number	Routine name	Maximum execution times	
01	Test all diagnostics routines	5 to 6	minutes
10	Microprocessor self diagnostics	400	µs
11	LSR test partial	400	µs
12	Local memory read write test	900	µs
14	External register write and sense bus test	400	µs
15	Timer function test	800	µs
20	Diagnostics program of controller interface printed circuit assembly 1	1.2	ms
21	Diagnostics program of controller interface printed circuit assembly 2	1.2	ms
22	Diagnostics program of tape unit interface printed circuit assembly	1.8	ms
23	Routine to confirm MTU selection	400	µs
24	FMT-MTU data bus test	1.2	ms
25	Tach pulse signal test	5	ms
26	Tape speed detection circuit test	3	ms
28	Repositioning counter and counter control test	5	ms
29	Trap circuit test	5	seconds
30	FMT LSI scan test	12	seconds
31	Time sensor and decoder test	500	ms
32	Loop write/read (LWR) FMT phase encode	6	ms
33	Loop write/read FMT group coded recording	3	ms
34	Loop write/read FMT nonreturn to zero I	6	ms
35	Loop write/read TU IF (tape unit interface) phase encode	6	ms
36	Loop write/read TU IF group coded recording	3	ms
37	Loop write/read TU IF nonreturn to zero I	6	ms
38	Loop write/read phase encoded format	3	seconds
39	Loop write/read group coded recording	4	seconds
40	Error correction logic phase encode	5	seconds
41	Group coded recording 1 track correction test	22	ms
42	Group coded recording 2 track correction test	16	ms
43	Group coded recording 3 track mask test	3	ms
44	Phase error pointer test	32	ms
45	Nonreturn to zero I correction test	24	ms
46	FMT control circuit test	22	ms

Table C.2 Summary of online diagnostic routines (continued)

Routine number	Routine name	Maximum execution times	
50	Reel servo test (simple turn)	8	seconds
51	Reel servo margin test	30	seconds
52	Capstan simple running test	27	seconds
53	Write current on test	2	seconds
54	Auto cleaner test	15	seconds
55	Capstan servo margin test 1600 rows per inch write	42	seconds
56	Capstan servo margin test 1600 rows per inch forward and backward read	1.5	minutes
57	Capstan servo margin test 6250 rows per inch write	38	seconds
58	Capstan servo margin test 6250 rows per per inch forward and backward read	40	seconds
60	Erase effect test	7	seconds
61	Self amplitude gain control circuit test	7	seconds
62	Group coded recording normal write test	7	seconds
63	PE normal write test	7	seconds
64	Nonreturn to zero I normal write test	7	seconds
65	Slice margin and read level test	6	seconds
66	IBG (inter block gap) length check test	15	seconds
70	Feed through test	7	seconds
71	Cross talk test	7	seconds
73	Phase Encode (PE) total read and write test	10	seconds
74	Group coded recording (GCR) total read and write test	10	seconds
75	Non return to zero I total read and write test	8	seconds
90	Tape retention action utility	600	μ s

Note: Routines 79 through 83 and routines 91 through 98 are available in the online diagnostics mode.

C.3.1 Performing online diagnostics

Follow these steps to initiate online diagnostics:

- (1) Ensure power to FMT is off.
- (2) Connect the field tester to the FMT (refer to Part I for a description of how to use the field tester.)
- (3) Turn power on.
- (4) Set the ONL/OFL switch on the field tester to OFL.
- (5) Set the field tester switches 0-7 to \$B2, and then toggle the CNT switch.
- (6) Set switches to \$17 and toggle the SSS switch.
- (7) Set switches to \$3D and toggle the SSS switch.
- (8) Set switches to \$B2 and toggle the CNT switch.
- (9) Set switches to \$00 and toggle the SSS switch. (\$01 would select MTU #1, etc.)
- (10) Set switches to \$3E and toggle the SSS switch.
- (11) Set switches to \$B2 and toggle the CNT switch.
- (12) Set switches to XY and toggle the SSS switch. (XY is any control parameter such as stop and repeat modes.)
- (13) Set switches to \$3C and toggle the SSS switch.
- (14) Set switches to \$B2 and toggle the CNT switch.
- (15) Set switches to \$01 and toggle the SSS switch.
- (16) Set switches to \$38 and toggle the SSS switch.
- (17) Set switches to \$B2 and toggle the CNT switch.
- (18) Set switches to \$XY and toggle the SSS switch. (XY = any desired online routine.)
- (19) Set switches to \$39 and toggle the SSS switch.
- (20) Toggle the SSS switch to start the routine.

If the repeat and error stop modes (\$82) are set (\$00 disables these modes), the FMT repeats the command until an error is detected.

C.3.2 Termination of online diagnostics

If the TMTS is successfully run, the MTS will not assert octal code 302, and the host/controller will know that the MTS is operational. Otherwise, 302 will be asserted, and routine and error code will be stored in hex notation in FMT registers \$35 and \$36. The FMT registers can be accessed using the field tester. The routine number and associated error codes can be found in the error code table (see Section C.4) and corrective action can then be implemented. The error code table also lists the faulty circuit card and/or subassembly that caused the error.

C.4 Error Code Table and Fault Isolation

This section lists error codes for both offline and online diagnostics. All routine numbers and error codes are in hex notation. The error code 00 for any routine means that the diagnostics were successfully completed, and no error was detected. The designation XX for routine number means that the associated error code can occur in any routine number. Similarly, an X designation for error code, for example X5, means any error code ending with the digit 5, where X = any digit from 0 through 9.

Routine number	Error Code	Description	Fault location
XX	80	Interruption by manual action in MTU.	Operator error
XX	81	TAG control was attempted to MTU, but the response signal (TAG IN signal) was not set.	532403U
XX	82	Although MTU failed to be set in write or erase status, HWC and HEC (write or erase) were reported normally. MTU failed in status/control/command TAG operation.	532401U
XX	83	MTU was not set to write status because HWC or HEC (write or read) cannot be on.	Write/read PCA
XX	84	MTU was not set in erase status HWC was reported or HEC was not reported.	
XX	85	When MTU was not set in forward status or backward status, HWC or HEC was reported.	Write/read PCA
XX	95	Stop signal was detected during online diagnostic routine. (Only the controller should reset stop signal).	PCA 1A07 in the FMT
XX	96	Beginning of tape was not detected during rewind operation.	Beginning of tape sensor, TKBMU
XX	97	Tag in signal was set during sense tag operation of MTU sense byte BYTE 3.	532403U

Routine number	Error Code	Description	Fault location
XX	98	Online signal was reset during rewind operation; verify tape operation.	Operator error
10	01	LM (local memory) \$10 access error.	PCA 1A08 in the FMT
10	77	Error was detected at command instruction of microprocessor.	PCA 1A08 in the FMT
11	01	LM (local memory) \$11 through \$17 access error.	PCA 1A08 in the FMT
12	01	Data cannot be written/read in Work Register 0 and 1 (W0, W1) of microprocessor.	PCA 1A08 in the FMT
12	02	Error was detected in local storage memory other than the work register.	PCA 1A08 in the FMT
14	01	Error was detected at external register selection circuit on printed circuit assembly (microprocessor address 4X).	PCA 1A08 in the FMT
14	02	Error was detected at external register on printed circuit assembly (microprocessor address 4X).	PCA 1A08 in the FMT
14	03	Error was detected at printed circuit assembly (microprocessor). (Test magnetic tape system flag bit error.)	PCA 1A08 in the FMT
14	04	CMR register or ADR register error.	PCA 1A07 in the FMT
14	05	Error was detected at controller interface, FCUST register error.	PCA 1A07 in the FMT
14	07	SIF register error.	PCA 1A07 in the FMT
14	08	XCTL register error.	PCA 1A07 in the FMT
14	09	Error was detected at write PCA. MASK register error.	PCA 1A06 in the FMT

Routine number	Error Code	Description	Fault location
14	10	Error was detected at write PCA. DACTL register error.	PCA 1A06 in the FMT
14	11	Error was detected at write PCA. WTCTL register error.	PCA 1A06 in the FMT
14	12	Error was detected at write PCA. RDCTL register error.	PCA 1A06 in the FMT
14	13	Error was detected at write PCA. MODE register error.	PCA 1A06 in the FMT
14	14	Error was detected at write PCA. RDSNS register error.	PCA 1A06 in the FMT
14	15	Error was detected at write PCA. CRCST register error.	PCA 1A06 in the FMT
14	16	Error was detected at write PCA. FMERR register error.	PCA 1A02 or PCA 1A06 in the FMT
14	17	Error was detected at external register on read PCA. TSNS register error.	PCA 1A02 in the FMT
14	18	Error was detected at external register on read PCA. POINT register error.	PCA 1A02 in the FMT
14	19	Error was detected at external register on read PCA. BLFMT register error.	PCA 1A01, 1A02, or 1A06 in the FMT
14	20	Error was detected at external register on read PCA. RDERR register error.	PCA 1A02, in the FMT
14	21	Printed circuit assembly (PCA) for nonreturn to zero I mode was not mounted for tri-density unit testing.	PCA 1A01 in the FMT
14	22	Selecting address \$6, read bus error detected.	PCA 1A01 or 1A08 in the FMT
14	23	ZETK register error.	PCA 1A01 in the FMT
14	24	ZCTL register error.	PCA 1A01 in the FMT
14	25	ZMRG register error.	PCA 1A01 in the FMT

Routine number	Error Code	Description	Fault location
14	26	Error was detected at external register on MTU interface. TMCTL register error.	PCA 1A05 in the FMT
14	27	Error was detected at external register on MTU interface. DVBO register error.	PCA 1A05 in the FMT
14	28	Error was detected at external register on MTU interface. DVBI register error.	PCA 1A05 in the FMT
15	10	M.TMR bit cannot be reset.	PCA 1A05 in the FMT
15	11	CTRU bit cannot be reset.	PCA 1A05 in the FMT
15	12	CTRU bit cannot be set.	PCA 1A05 in the FMT
15	13	CTRU bit cannot be set.	PCA 1A05 in the FMT
15	14	Data was not set correctly in the upper bytes of timer.	PCA 1A05 in the FMT
15	15	Error was detected at the lower bytes of timer.	PCA 1A05 in the FMT
15	16	Error was detected at the lower bytes of timer.	PCA 1A05 in the FMT
15	17	Error was detected at the lower bytes of timer.	PCA 1A05 in the FMT
15	18	CTRU bit cannot be set.	PCA 1A05 in the FMT
15	19	Error was detected at the upper bytes of timer.	PCA 1A05 in the FMT
20	01	Data was not set correctly in external register. Error occurs only during online diagnostics.	PCA 1A07 in the FMT
20	02	Data in CMR register is changed during BUSY. Error occurs only during online diagnostics.	PCA 1A07 in the FMT
20	03	BUSPE bit was not reset.	PCA 1A07 in the FMT

Routine number	Error Code	Description	Fault location
20	05	Data of ADR register was changed during BUSY. Error occurs only during online diagnostics.	PCA 1A07 in the FMT
20	06	Data was not set correctly in FCUST register.	PCA 1A07 in the FMT
20	07	Data was not set correctly in TUST/SIF register.	PCA 1A07 in the FMT
20	08	SIF register read/write error.	PCA 1A07 in the FMT
20	09	MXTL register read/write error.	PCA 1A07 in the FMT
20	15	ADR register was not reset. Error occurs only during offline diagnostics.	PCA 1A07 in the FMT
21	01	Data was not set correctly in external register. Error occurs only during online diagnostics.	PCA 1A07 in the FMT
21	02	Data in CMR register is changed during BUSY. Error occurs only during online diagnostics.	PCA 1A07 in the FMT
21	03	BUSPE bit was not reset.	PCA 1A07 in the FMT
21	04	TREQ/TRAX (transfer request/transfer acknowledge) bit was not set/reset. Error occurs only during offline diagnostics.	PCA 1A07 in the FMT
21	05	Data of ADR (address) register was changed during BUSY. Error occurs only during online diagnostics.	PCA 1A07 in the FMT
21	06	Data was not set correctly in FCUST register.	PCA 1A07 in the FMT
21	07	Data was not set correctly in TUST/SIF (tape unit status/status in function) register.	PCA 1A07 in the FMT
21	08	SIF (status in function) register read/write error.	PCA 1A07 in the FMT

Routine number	Error Code	Description	Fault location
21	09	MXTL register read/write error.	PCA 1A07 in the FMT
21	15	ADR (address) register was not reset. Error occurs only during offline diagnostics.	PCA 1A07 in the FMT
22	01	D.FTP and D.QTP bits were not reset.	PCA 1A05 in the FMT
22	02	Data was not set/reset correctly in TMCTL register.	PCA 1A05 in the FMT
22	03	Data was not set/reset correctly in TMCTL register.	PCA 1A05 in the FMT
22	04	Data was not set/reset correctly in TMCTL register.	PCA 1A05 in the FMT
22	05	Data was not set/reset correctly in TMCTL register.	PCA 1A05 in the FMT
22	06	Data was not set/reset correctly in TIMER register.	PCA 1A05 in the FMT
22	07	Data was not set/reset correctly in TIMER register.	PCA 1A05 in the FMT
22	08	Data was not set/reset correctly in DVSEL register.	PCA 1A05 in the FMT
22	09	Data was not set/reset correctly in DVSEL register.	PCA 1A05 in the FMT
22	11	Data was not set/reset correctly in TPCNT register.	PCA 1A05 in the FMT
22	12	Data was not set/reset correctly in DVTAG register.	PCA 1A05 in the FMT
22	13	Loop data was not sensed.	PCA 1A05 in the FMT
22	14	Loop data was not sensed.	PCA 1A05 in the FMT
22	15	Error in write data mode.	PCA 1A05 in the FMT
22	16	Malfunction in DBMPX Bit. Error in write data mode.	PCA 1A05 in the FMT
22	17	Malfunction in DBMPX Bit. Error in write data mode.	PCA 1A05 in the FMT

Routine number	Error Code	Description	Fault location
22	18	Malfunction in DBMPX Bit. Error in write data mode.	PCA 1A05 in the FMT
22	19	Malfunction in DBMPX Bit.	PCA 1A05 in the FMT
22	20	UQID was not sensed.	PCA 1A05 in the FMT
23	X1	Error detected in MTU #0 selection logic.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU #0
23	X2	Error detected in MTU #1 selection logic.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU #1
23	X3	Error detected in MTU #2 selection logic.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU #2
23	X4	Error detected in MTU #3 selection logic.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU #3
23	X5	Error detected in MTU #4 selection logic.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU #4
23	X6	Error detected in MTU #5 selection logic.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU #5
23	X7	Error detected in MTU #6 selection logic.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU #6
23	X8	Error detected in MTU #7 selection logic.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU #7

Routine number	Error Code	Description	Fault location
23	X9	TAG control executed to the selected MTU, but TAG IN signal was not set.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU
23	10	Data was not set/reset correctly at the selection MTU.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU
23	20	Communication register of selected MTU cannot be reset.	532403U distribution PCA in the FMT in MTU
24	04	Error in data transfer between formatter and MTU.	PCA 1A05 and distribution PCA in the FMT 532403U in MTU
25	01	Malfunction of tach stop pulse detection.	PCA 1A05 in the FMT
25	02	Malfunction of tach pulse stop detection.	PCA 1A05 or 1A06 in the FMT
25	03	Malfunction of tach stop pulse detection.	PCA 1A05 in the FMT
25	04	D.FTP or D.QTP were not detected.	TU interface cable, PCA 1A05 and distribution PCA in the FMT 532403U and PCA 1A04 in the MTU
25	05	D.FTP or D.QTP were not detected.	TU interface cable, PCA 1A04 and 1A05 and distribution PCA in the FMT 532403U and PCA 1A04 in the MTU
25	06	The number of D.FTP and D.QTP is incorrect.	532403U and PCA 1A04 in the MTU, PCA 1A05 in the FMT
25	07	The number of D.FTP and D.QTP is incorrect.	532403U and PCA 1A04 in the MTU, PCA 1A05 in the FMT

Routine number	Error Code	Description	Fault location
25	08	Error in sequence of FTP (Full Tacho-Pulse) and QTP (Quarter Tacho-Pulse) signals.	532403U and PCA 1A04 in the MTU, PCA 1A05 in the FMT
26	01	Error detected in GAPC (Gap Control) signal.	532403U, PCA 1A05 and distribution PCA in the FMT
26	02	Malfunction of speed detection.	PCA 1A05 in the FMT
26	03	VLOK (Velocity OK) signal was not detected.	PCA 1A05 in the FMT, PCA 1A04 or tape drive A in the MTU, or Capstan motor assembly photo sense block
26	04	Error detected in GAPC (Gap Control) signal.	PCA 1A05 in the FMT, PCA 1A04 or tape drive A in the MTU, or Capstan motor assembly photo sense block
26	05	Error detected in GAPC (Gap Control) and VLOK (Velocity OK) signal.	PCA 1A05 in the FMT, PCA 1A04 or tape drive A in the MTU, or Capstan motor assembly photo sense block
26	10	VLCHG (Velocity Change) signal was not reset.	PCA 1A05 or 1A06 in the FMT
26	11	VLCHG (Velocity Change) signal was not reset.	PCA 1A05 or 1A06 in the FMT
26	12	VLCHG (Velocity Change) signal was not detected.	PCA 1A05 or 1A06 in the FMT
26	13	VLOK (Velocity OK) signal was not reset.	PCA 1A05 or 1A06 in the FMT
28	01	Error detected in the UP count mode of reposition counter.	PCA 1A05 in the FMT
28	10	Error detected in the UP count mode of reposition counter.	PCA 1A05 in the FMT
28	11	Carry bit of reposition counter was not detected.	PCA 1A05 in the FMT

Routine number	Error Code	Description	Fault location
28	12	Carry bit of reposition counter was not reset.	PCA 1A05 in the FMT
28	13	Error detected in the down count mode of reposition counter.	PCA 1A05 in the FMT
28	14	Reposition counter was not reset.	PCA 1A05 in the FMT
29	01	Expected timer trap did not occur.	PCA 1A05 or 1A08 in the FMT
29	02	MTU was interrupted by manual action, or unexpected interruption occurred.	532401U in the MTU, PCA 1A05, 1A08, or distribution PCA in the FMT
29	03	Tacho stop was detected in spite of GAPC and VLCK (Velocity Check) assertion.	PCA 1A05 in the FMT
29	04	MTU was interrupted by manual action, or unexpected interruption occurred.	532401U in the MTU, PCA 1A05, 1A08, or distribution PCA in the FMT
29	05	Tacho stop signal was not detected within the specified period.	PCA 1A05 in the FMT
29	10	MTU was interrupted by manual action, or unexpected interruption occurred.	532401U in the MTU, PCA 1A05, 1A08, or distribution PCA in the FMT
29	11	T.INT signal was not detected within the specified period.	532403U in the MTU, or PCA 1A05 in the FMT
29	15	Unexpected trap occurred.	PCA 1A05 or 1A07 in the FMT
29	8X	TAG control was executed at the specified MTU address, but failed.	
30	01	Error detected in LSI of write formatter.	PCA 1A06 or 1A07 in the FMT

Routine number	Error Code	Description	Fault location
30	02	Error detected in LSI of write formatter.	PCA 1A06 or 1A07 in the FMT
30	11	Error detected in LSI of read formatter.	PCA 1A02 or 1A07 in the FMT
30	12	Error detected in LSI of read formatter.	PCA 1A02 or 1A07 in the FMT
31	01	GCR (group coded recording) MP (microprogram) mode (time sense P bit on) test error.	550157U, PCA 1A02 or 1A05 in the FMT
31	02	PE (phase encode) MP (microprogram) mode (time sense P bit on) test error.	550157U, PCA 1A02 or 1A05 in the FMT
31	03	GCR (group coded recording) MP (microprogram) mode (time sense 0 - 7 on) test error.	550157U, PCA 1A02, 1A05 or 1A06 in the FMT
31	04	PE (phase encode) MP (microprogram) mode (time sense 0 - 7 on) test error.	550157U, PCA 1A02, 1A05 or 1A06 in the FMT
31	05	GCR (group coded recording) MP (microprogram) mode (time sense P bit off) test error.	550157U or PCA 1A02 in the FMT
31	06	PE (phase encode) MP (microprogram) mode (time sense P bit off) test error.	550157U or PCA 1A02 in the FMT
31	07	GCR (group coded recording) MP (microprogram) mode (time sense 0 - 7 off) test error.	550157U or PCA 1A02 in the FMT
31	08	PE (phase encode) MP (microprogram) mode (time sense 0 - 7 off) test error.	550157U or PCA 1A02 in the FMT
31	12	ALL1W (all 1 write) mode time sense error.	PCA 1A05 or 1A06 in the FMT
31	13	ALL1W (all 1 write) mode time sense error.	PCA 1A05 or 1A06 in the FMT
31	14	ALL1W (all 1 write) mode time sense error.	PCA 1A05 or 1A06 in the FMT

Routine number	Error Code	Description	Fault location
31	15	ALL1W (All 1 Write) mode time sense error.	PCA 1A05 or 1A06 in the FMT
31	20	Block format in formatter read status cannot be detected.	PCA 1A05 or 1A06 in the FMT
31	21	Block format in formatter read status cannot be detected.	PCA 1A05 or 1A06 in the FMT
31	23	Block format in formatter read status cannot be detected.	PCA 1A05 or 1A06 in the FMT
31	29	BCU BIT was not detected.	PCA 1A05, 1A06, or 1A08 in the FMT
32	10	TNSNS (time sense) signal was not set correctly on more than one track.	550157U or PCA 1A02 in the FMT
32	11	DBOB (detection of beginning of block) signal was not set correctly.	PCA 1A02 in the FMT
32	12	HBLX or HNOIS signal was not set correctly.	PCA 1A02 or 1A06 in the FMT
32	13	PHOK (phase OK) signal was not set correctly.	PCA 1A06 in the FMT
32	14	PREA (preamble detected) signal was not set correctly.	PCA 1A02 or 1A06 in the FMT
32	15	Unexpected STRDC signal detected.	PCA 1A06 in the FMT
32	16	POSA (postamble) signal was not detected in time.	PCA 1A02, 1A06, or 1A07 in the FMT
32	17	Error correction pointer was detected.	550157U, PCA 1A02, 1A05, or 1A06 in the FMT
32	19	DBOB (detection of beginning of block) signal was detected before detection of EPOSA.	PCA 1A06 in the FMT
32	20	FMT detected postamble error.	PCA 1A08 in the FMT

Routine number	Error Code	Description	Fault location
32	21	IBG (inter block gap) was not detected correctly.	550157U
32	22	FMT detected end data check.	PCA 1A02, 1A05, or 1A06 in the FMT
32	23	Error was detected at BCU interval during storage of write data into the data buffer.	PCA 1A05 or 1A06 in the FMT
32	26	BIBSY (bus in busy) signal was not reset correctly.	PCA 1A05 or 1A07 in the FMT
32	27	FMT detected slip check.	PCA 1A06 in the FMT
32	41	FMT detected skew error.	550157U, or PCA 1A02 in the FMT
32	42	FMT detected drop out error.	PCA 1A02 in the FMT
32	43	FMT detected VRC (vertical redundancy check) error.	PCA 1A02 in the FMT
32	44	FMT detected multi-track error.	PCA 1A02 in the FMT
32	45	FMT detected postamble error.	PCA 1A02 in the FMT
32	46	FMT detected WVRC (write VRC) error.	PCA 1A02 in the FMT
32	47	FMT detected write bus out parity error.	PCA 1A06 or 1A07 in the FMT
32	48	FMT detected over-run error.	PCA 1A01, 1A02, or 1A06 in the FMT
32	54	CRC (cyclic redundancy check) status transfer buffer is being checked.	PCA 1A05, 1A06, or 1A07 in the FMT
32	55	CRC (cyclic redundancy check) status was A \neq B.	PCA 1A06 in the FMT
32	56	BUS parity error was detected.	PCA 1A07 in the FMT
32	8X	TAG control was executed at the specified MTU address but failed.	

Routine number	Error Code	Description	Fault location
33	10	TNSNS (time sense) signal was not set correctly on more than one track.	550157U, PCA 1A02 or 1A05 in the FMT
33	11	DBOB (detection of beginning of block) signal was not set correctly.	PCA 1A02 in the FMT
33	12	HBLX or HNOIS signal was not set correctly.	PCA 1A02 or 1A06 in the FMT
33	13	PHOK (phase OK) signal was not set correctly.	PCA 1A02 or 1A06 in the FMT
33	14	PREA (preamble detected) signal was not set correctly.	PCA 1A02 or 1A06 in the FMT
33	15	Unexpected STRDC signal detected.	PCA 1A02 or 1A06 in the FMT
33	16	POSA (postamble) signal was not detected in time.	PCA 1A02 or 1A06 in the FMT
33	17	Error correction pointer was detected.	550157U, PCA 1A02 in the FMT
33	19	DBOB (detection of beginning of block) signal was detected before detection of EPOSA (postamble read end condition).	PCA 1A06 in the FMT
33	20	FMT detected postamble error.	PCA 1A02 in the FMT
33	21	IBG (inter block gap) was not detected correctly.	550157U
33	22	FMT detected end data check.	PCA 1A02 or 1A06 in the FMT
33	23	Error was detected at BCU interval during storage of write data into the data buffer.	PCA 1A05 or 1A06 in the FMT
33	26	BIBSY (bus in busy) signal was not reset correctly.	PCA 1A05 or 1A07 in the FMT
33	27	FMT detected slip check.	PCA 1A06 in the FMT

Routine number	Error Code	Description	Fault location
33	40	FMT detected deskewing buffer error.	PCA 1A02 in FMT
33	41	FMT detected skew error.	550157U, PCA 1A02 in the FMT
33	42	FMT detected drop-out error.	PCA 1A02 in the FMT
33	43	FMT detected VRC (vertical redundancy check) error.	PCA 1A02 or 1A05 in the FMT
33	44	FMT detected multi-track error.	PCA 1A02 in the FMT
33	45	FMT detected postamble error.	PCA 1A02 in the FMT
33	46	FMT detected WVRC (write vertical redundancy check) error.	PCA 1A06 in the FMT
33	47	FMT detected write bus out parity error.	PCA 1A06 or 1A07 in the FMT
33	48	FMT detected over-run error.	PCA 1A01, 1A02 or 1A06 in the FMT
33	54	CRC (cyclic redundancy check) status transfer buffer is being checked.	PCA 1A05, 1A06, or 1A07 in the FMT
33	55	CRC (cyclic redundancy check) status was A \neq B.	PCA 1A06 in the FMT
33	56	BUS parity error was detected.	PCA 1A07 in the FMT
33	8X	TAG control was executed at the specified MTU address but failed.	
34	01	RDB.S signal is not set correctly.	PCA 1A01 and 1A06 in the FMT
34	02	FMT cannot reset RDB.S signal.	PCA 1A01 in the FMT
34	03	MBLKZ signal was not set correctly.	PCA 1A01 in the FMT

Routine number	Error Code	Description	Fault location
34	04	LRC (longitudinal redundancy check), CRC (cyclic redundancy check), BLKED (NRZ block end), CRCHG (CRC horizontal gap) or CRCRG (CRC recording gap) signal was detected at illegal timing.	PCA 1A01 in the FMT
34	05	RDB.S signal did not appear in specified period.	PCA 1A01 in the FMT
34	06	LRC (longitudinal redundancy check), CRC (cyclic redundancy check), BLKED (NRZ block end), CRCHG (CRC horizontal gap) or CRCRG (CRC recording gap) signal was detected at illegal timing.	PCA 1A01 in the FMT
34	09	CRCRG and CRCHG signal was set at the same time.	PCA 1A01 in the FMT
34	10	CRC data was detected too early. Timing error.	PCA 1A06 in the FMT
34	11	RDB.S signal was not set correctly with the CRC data.	PCA 1A06 in the FMT
34	12	LRC signal was not set.	PCA 1A04 in the FMT
34	13	RDB.S signal was not set correctly with the CRC data.	PCA 1A06 in the FMT
34	15	CRCHG signal was detected, but LRC data was detected.	PCA 1A06 in the FMT
34	16	CRCHG and LRC data were not detected.	PCA 1A01 in the FMT
34	17	CRC data and LRC signal were not detected.	PCA 1A01 or 1A06 in the FMT
34	18	CRC data and LRC data were not detected.	PCA 1A01 in the FMT
34	19	BLKE (Block End) signal was detected before CRC and LRC data.	PCA 1A01 in the FMT

Routine number	Error Code	Description	Fault location
34	20	Noise data was detected after LRC data.	550157U, PCA 1A06 in the FMT
34	21	BLKE signal was detected too early. Timing error.	PCA 1A01 in the FMT
34	22	CRCHG signal was not detected within the specified period.	PCA 1A01 in the FMT
34	27	Slow end error.	PCA 1A06 in the FMT
34	28	BLKE signal was detected too early. Timing error.	PCA 1A01 in the FMT
34	29	CRCHG signal was not detected.	PCA 1A01 in the FMT
34	30	BLKE signal was not detected within the specified period.	PCA 1A01 in the FMT
34	31	Slow end error.	PCA 1A06 in the FMT
34	32	VRC (vertical redundancy check) error.	PCA 1A01 in the FMT
34	33	Skew error.	PCA 1A01 in the FMT
34	34	LRC (longitudinal redundancy check) error.	PCA 1A01 in the FMT
34	35	SDRST (sense data reset) function error.	PCA 1A01 in the FMT
35	10	TNSNS (time sense) signal was not set correctly on more than one track.	550157U, distribution PCA in the FMT
35	40	FMT detected deskewing buffer error.	PCA 1A02 in the FMT
35	41	FMT detected skew error.	532403U
35	42	FMT detected drop out error.	532403U
35	43	FMT detected VRC (vertical redundancy check) error.	PCA 1A02 or 1A05 in the FMT, 550157U
35	44	FMT detected multi-track error.	PCA 1A02 in the FMT
35	45	FMT detected postamble error.	PCA 1A02 in the FMT

Routine number	Error Code	Description	Fault location
35	46	FMT detected WVRC (write vertical redundancy check) error.	PCA 1A06 in the FMT
35	47	FMT detected write bus out parity error.	PCA 1A06 or 1A07 in the FMT
35	48	FMT detected over-run error.	PCA 1A01, 1A02, or 1A06 in the FMT
35	54	CRC (cyclic redundancy check) status (transfer buffer is being checked).	PCA 1A06 or 1A07 in the FMT
35	55	CRC status was A \neq B.	PCA 1A06 in the FMT
35	56	BUS parity error was detected.	PCA 1A07 in the FMT
35	8X	TAG control was executed at the specified MTU address but failed.	
36	10	TNSNS (time sense) signal was not set correctly on more than one track.	550157U, PCA 1A05 or distribution PCA in the FMT
36	40	FMT detected deskewing buffer error.	PCA 1A02 in the FMT
36	41	FMT detected skew error.	532403U
36	42	FMT detected drop-out error.	532403U
36	43	FMT detected VRC (vertical redundancy check) error.	PCA 1A02 or PCA 1A05 in the FMT, 550157U
36	44	FMT detected multi-track error.	PCA 1A02 in the FMT
36	45	FMT detected postamble error.	PCA 1A02 in the FMT
36	46	FMT detected WVRC (write vertical redundancy check) error.	PCA 1A06 in the FMT
36	47	FMT detected write bus out parity error.	PCA 1A06 or 1A07 in the FMT
36	48	FMT detected over-run error.	PCA 1A01, 1A02, or 1A06 in the FMT

Routine number	Error Code	Description	Fault location
36	54	CRC status (transfer buffer is being checked).	PCA 1A06 or 1A07 in the FMT
36	55	CRC status was A \neq B.	PCA 1A06 in the FMT
36	56	BUS parity error was detected.	PCA 1A07 in the FMT
36	8X	TAG control was executed at the specified MTU address but failed.	
37	01	RDB.S signal is not set correctly.	PCA 1A01 or 1A06 in the FMT, 550157U
37	02	FMT cannot reset RDB.S signal.	PCA 1A01 in the FMT
37	8X	TAG control was executed at the specified MTU address but failed.	
38	10	TNSNS (time sense) signal was not set correctly on more than one track.	Write/read PCA, or cable between 532403U and write/read PCA
38	12	HBLX or HNOIS signal was not set correctly.	Write/read PCA
38	14	PREA (preamble) signal was not set correctly.	Write/read PCA
38	16	POSA (postamble) signal was not detected in time.	Write/read PCA
38	19	DBOB (detection of beginning of block) signal was detected before detection of EPOSA.	Write/read PCA
38	20	FMT detected postamble error.	Write/read PCA
38	21	IBG (inter block gap) was not detected correctly.	Write/read PCA
38	22	FMT detected end data check.	Write/read PCA
38	41	FMT detected skew error.	Write/read PCA
38	42	FMT detected drop-out error.	Write/read PCA

Routine number	Error Code	Description	Fault location
38	43	FMT detected VRC (vertical redundancy check) error.	Write/read PCA
38	44	FMT detected multi-track error.	Write/read PCA
38	45	FMT detected postamble error.	Write/read PCA
38	46	FMT detected WVRC (write VRC) error.	PCA 1A06 in the FMT
38	47	FMT detected write bus out parity error.	PCA 1A06 or 1A07 in the FMT
38	48	FMT detected over-run error.	PCA 1A01, 1A02 or 1A06 in the FMT
38	54	CRC (cyclic redundancy check) status (transfer bus is being checked).	PCA 1A06 or 1A07 in the FMT
38	55	CRC status was A \neq B.	PCA 1A06 in the FMT
38	56	BUS parity error was detected.	PCA 1A07 in the FMT
38	8X	TAG control was executed at the specified MTU address but failed.	
38	96	Error was detected at beginning of tape sensor.	Operator error or beginning of tape sensor
38	98	Manual operation was detected in selected MTU.	Operator error
39	10	TNSNS (time sense) signal was not set correctly on more than one track.	Write/read PCA or cable between 532403U and write/read PCA
39	12	HBLX or HNOIS signal was not set correctly.	Write/read PCA
39	14	PREA (preamble) signal was not set correctly.	Write/read PCA
39	16	POSA (postamble) signal was not detected in time.	Write/read PCA

Routine number	Error Code	Description	Fault location
39	19	DBOB (detection of beginning of block) signal was detected before detection of EPOSA (postamble read end condition).	Write/read PCA
39	20	FMT detected postamble error.	Write/read PCA
39	21	IBG (inter block gap) was not detected correctly.	Write/read PCA
39	22	FMT detected end data check.	Write/read PCA
39	38	Beginning of tape signal cannot be reset.	Beginning of tape sensor or faulty tape
39	40	FMT detected deskewing buffer error.	PCA 1A02 in the FMT
39	41	FMT detected skew error.	Write/read PCA
39	42	FMT detected drop out error.	Write/read PCA
39	43	FMT detected VRC (vertical redundancy check) error.	Write/read PCA
39	44	FMT detected multi-track error.	Write/read PCA
39	45	FMT detected postamble error.	Write/read PCA
39	46	FMT detected WVRC (write vertical redundancy check) error.	PCA 1A06 in the FMT
39	47	FMT detected write bus out parity error.	PCA 1A06 or 1A07 in the FMT
39	48	FMT detected over-run error.	PCA 1A01, 1A02 or 1A06 in the FMT
39	54	CRC status (transfer buffer is being checked).	PCA 1A06 or 1A07 in the FMT
39	55	CRC (cyclic redundancy check) status was A \neq B.	PCA 1A06 in the FMT
39	56	BUS parity error was detected.	PCA 1A07 in the FMT

Routine number	Error Code	Description	Fault location
39	8X	TAG control was executed at the specified MTU address but failed.	
39	90	FMT failed to set the MTU into group coded recording status.	532401U, 532403U
40	01	Error detected in ECC (error correction character) function.	PCA 1A02 in the FMT
40	03	P-bit (parity bit) pointer was not matched with mask bit.	PCA 1A02 in the FMT
40	04	Pointer does not match mask pattern.	PCA 1A02 in the FMT
40	05	VRC (vertical redundancy check) error bit was set incorrectly.	550157U, or PCA 1A02 in the FMT
40	07	1 or 2 MLT (multiple track) and VRC (vertical redundancy check) were set.	PCA 1A02 in the FMT
40	09	1 or 2 VRC (vertical redundancy check) were set.	PCA 1A02 in the FMT
40	10	TSNS (time sense) did not match MASK pattern.	PCA 1A02 in the FMT
40	14	1 or 2 was set in write mode.	PCA 1A02 in the FMT
41	01	Error detected in ECC (error correction character) function.	PCA 1A02 in the FMT
41	03	P-bit (parity bit) pointer was not matched with mask bit.	PCA 1A02 in the FMT
41	04	Pointer does not match mask pattern.	PCA 1A02 in the FMT
41	05	VRC (vertical redundancy check) error bit was set incorrectly.	550157U, or PCA 1A02 in the FMT
41	07	1 or 2 MLT (multiple track) and VRC (vertical redundancy check) were set.	PCA 1A02 in the FMT

Routine number	Error Code	Description	Fault location
41	09	1 or 2 VRC (vertical redundancy check) were set.	PCA 1A02 in the FMT
41	10	TSNS (time sense) did not match MASK pattern.	PCA 1A02 in the FMT
42	01	Error detected in ECC (error correction character) function.	PCA 1A02 in the FMT
42	03	P-bit (parity bit) pointer was not matched with mask bit.	PCA 1A02 in the FMT
42	04	Pointer does not match mask pattern.	PCA 1A02 in the FMT
42	05	VRC (vertical redundancy check) error bit was set incorrectly.	PCA 1A02 in the FMT
42	07	1 or 2 MLT (multiple track) and VRC (vertical redundancy check) were set.	PCA 1A02 in the FMT
42	09	1 or 2 VRC (vertical redundancy check) were set.	PCA 1A02 in the FMT
42	10	TSNS (time sense) did not match MASK pattern.	PCA 1A02 in the FMT
43	01	Error detected in ECC (error correction character) function.	PCA 1A02 in the FMT
43	05	VRC (vertical redundancy check) error bit was set incorrectly.	PCA 1A02 in the FMT
43	07	1 or 2 MLT (multiple track) and VRC (vertical redundancy check) were set.	PCA 1A02 in the FMT
43	09	1 or 2 VRC (vertical redundancy check) were set.	PCA 1A02 in the FMT
43	10	TSNS (time sense) did not match MASK pattern.	PCA 1A02 in the FMT
44	01	Error detected in ECC (error correction character) function.	PCA 1A02 in the FMT

Routine number	Error Code	Description	Fault location
44	03	P-bit (parity bit) pointer was not matched with mask bit.	PCA 1A02 in the FMT
44	04	Pointer does not match mask pattern.	550157U, PCA 1A02 in the FMT
44	05	VRC (vertical redundancy check) error bit was set incorrectly.	PCA 1A02 in the FMT
44	06	MLT (multiple track) and VRC (vertical redundancy check) were set in two bits in mask/group coded recording/RD mode.	PCA 1A06 in the FMT
44	07	1 or 2 MLT (multiple track) and VRC (vertical redundancy check) were set.	PCA 1A02 in the FMT
44	10	TSNS (time sense) did not match MASK pattern.	PCA 1A02 in the FMT
44	14	1 or 2 was set in write mode.	PCA 1A02 in the FMT
45	01	RDB.S signal is not set correctly.	550157U, PCA 1A01 or PCA 1A06 in the FMT
45	02	FMT cannot reset RDB.S signal.	PCA 1A01 in the FMT
45	03	MBLKZ signal was not set correctly.	PCA 1A01 in the FMT
45	04	LRC (longitudinal redundancy check), CRC (cyclic redundancy check), BLKED (NRZ block end), CRCHG (CRC horizontal gap) or CRCRG (CRC recording gap) signal was detected at illegal timing.	PCA 1A01 in the FMT
45	05	RDB.S signal did not appear in specified period.	PCA 1A01 in the FMT
45	06	LRC (longitudinal redundancy check), CRC (cyclic redundancy check), BLKED (NRZ block end), CRCHG (CRC horizontal gap) or CRCRG (CRC recording gap) signal was detected at illegal timing.	PCA 1A01 in the FMT

Routine number	Error Code	Description	Fault location
45	09	CRCRG and CRCHG signal was set at the same time.	PCA 1A01 in the FMT
45	10	CRC data was detected too early. Timing Error.	PCA 1A06 in the FMT
45	11	RDB.S signal was not set correctly with the CRC data.	PCA 1A06 in the FMT
45	12	LRC signal was not set.	PCA 1A01 in the FMT
45	13	RDB.S signal was not set correctly with the CRC data.	PCA 1A06 in the FMT
45	15	CRCHG signal was detected, but LRC data was detected.	PCA 1A06 in the FMT
45	16	CRCHG and LRC data were not detected.	PCA 1A01 in the FMT
45	17	CRC data and LRC signal were not detected.	PCA 1A01 or 1A06 in the FMT
45	18	CRC data and LRC data were not detected.	PCA 1A01 in the FMT
45	19	BLKE (block end) signal was detected before CRC and LRC data.	PCA 1A01 in the FMT
45	20	Noise data was detected after LRC data.	550157U, PCA 1A06 in the FMT
45	21	BLKE signal was detected too early. Timing error.	PCA 1A01 in the FMT
45	22	CRCHG signal was not detected within the specified period.	PCA 1A01 in the FMT
45	27	Slow end error.	PCA 1A06 in the FMT
45	28	BLKE signal was detected too early. Timing error.	PCA 1A01 in the FMT
45	29	CRCHG signal was not detected.	PCA 1A01 in the FMT
45	30	BLKE signal was not detected within the specified period.	PCA 1A01 in the FMT

Routine number	Error Code	Description	Fault location
45	31	Slow end error.	PCA 1A06 in the FMT
45	32	VRC error.	PCA 1A01 in the FMT
45	33	Skew error.	PCA 1A01 in the FMT
45	34	LRC (longitudinal redundancy check) error.	PCA 1A01 in the FMT
45	35	SDRST (sense data reset) function error.	PCA 1A01 in the FMT
46	01	Window signal cannot be detected.	PCA 1A06 in the FMT
46	02	NOISE signal was not detected within specified period.	PCA 1A06 in the FMT
46	03	SLIPC (not slip check) signal was not detected within specified period.	PCA 1A01 or 1A06 in the FMT
46	04	SRDC (set condition) signal was not detected within specified period.	PCA 1A01 or 1A06 in the FMT
46	05	EDC (end data check) signal was not detected within specified period.	PCA 1A06 in the FMT
46	12	Noise signal was not detected within specified period.	PCA 1A01 or 1A06 in the FMT
46	13	SLIPC (not slip check) signal was not detected within specified period.	PCA 1A01 or 1A06 in the FMT
46	14	SRDC (set condition) signal was not detected within specified period.	PCA 1A01 or 1A06 in the FMT
46	15	EDC (end data check) signal was not detected within specified period.	PCA 1A06 in the FMT
50	11	Tape loop alarm left. Error detected in servo on machine reel side. Error was found during forward run.	PCA 1A04 in the MTU, or capacitive sensor

Routine number	Error Code	Description	Fault location
50	12	Tape loop alarm right. Error detected in servo on file reel side. Error was found during forward run.	PCA 1A04 in the MTU, or capacitive sensor
50	14	MTU check was found. Error was found during forward run.	
50	18	Ready signal was off. Error was found during forward run.	MTU PCA 1A05, 1A06 or operator error
50	21	Tape loop alarm left. Error detected in servo on machine reel side. Error was found during backward run.	PCA 1A04 in the MTU, or capacitive sensor
50	22	Tape loop alarm right. Error detected in servo on file reel side. Error was found during backward run.	PCA 1A04 in the MTU, or capacitive sensor
50	24	Analysis was done by error code of operator panel on MTU (for offline diagnostics). Analysis was done on MTU error code of DSB (Drive Sense Byte) 6 (for online diagnostics). Error was found during backward run.	Refer to MTU Error Code Table (See Section A.2)
50	28	Ready signal was off. Error was found during backward run.	MTU PCA 1A05, 1A06 or operator error
50	31	Tape loop alarm left. Error detected in servo on machine reel side. Error was found during change of direction from forward to backward.	PCA 1A04 in the MTU or capacitive sensor
50	32	Tape loop alarm right. Error detected in servo on file reel side. Error was found during change of direction from forward to backward.	PCA 1A04 in the MTU capacitive sensor

Routine number	Error Code	Description	Fault location
50	34	Analysis was done by error code of operator panel on MTU (for offline diagnostics). Analysis was done on MTU error code of DSB (drive sense byte) 6 (for online diagnostics). Error was found during change of direction from forward to backward.	Refer to MTU Error Code Table (See Section A.2)
50	38	Ready signal was off. Error was found during change of direction from forward to backward.	MTU PCA 1A05, 1A06 operator error
50	41	Tape loop alarm left. Error detected in servo on machine reel side. Error was found during backward short run.	PCA 1A04 in the MTU capacitive sensor
50	42	Tape loop alarm right. Error detected in servo on file reel side.	PCA 1A04 in the MTU capacitive sensor
50	44	Analysis was done by error code of operator panel on MTU (for offline diagnostics). Analysis was done on MTU error code of DSB (drive sense byte) 6 (for online diagnostics). Error was found during backward short run.	Refer to MTU Error Code Table (See Section A.2)
50	48	Ready signal was off. Error was found during backward short run.	MTU PCA 1A05, 1A06 operator error
51	11	Tape loop alarm left. Error detected in servo on machine reel side. Error was found during short go up/down forward run.	PCA 1A04 in the MTU, or capacitive sensor
51	12	Tape loop alarm right. Error detected in servo on file reel side. Error was found during short go up/down forward run.	PCA 1A04 in the MTU, or capacitive sensor

Routine number	Error Code	Description	Fault location
51	14	Error was found during short go up/down forward run.	Troubleshoot using error code indicated on front panel. Refer to Section A for error code list.
51	18	Ready signal was off. Error was found during short go up/down forward run.	MTU PCA 1A05, 1A06 or operator error
51	21	Tape loop alarm left. Error detected in servo on machine reel side. Error was found during long go up/down forward run.	PCA 1A04 in the MTU or capacitive sensor
51	22	Tape loop alarm right. Error detected in servo on file reel side. Error was found during long go up/down forward run.	PCA 1A04 in the MTU or capacitive sensor
51	24	Analysis was done by error code of operator panel on MTU (for offline diagnostics). Analysis was done on MTU error code of DSB 6 (for online diagnostics). Error was found during long go up/down forward run.	Refer to MTU Error Code Table (See Section A.2)
51	28	Ready signal was off. Error was found during long go up/down forward run.	MTU PCA 1A05, 1A06, or operator error
51	31	Tape loop alarm left. Error detected in servo on machine reel side.	PCA 1A04 in the MTU, or capacitive sensor
51	32	Tape loop alarm right. Error detected in servo on file reel side. Error was found during short forward to backward change of direction.	PCA 1A04 in the MTU, or capacitive sensor
51	34	Analysis was done by error code of operator panel on MTU (for offline diagnostics). Analysis was done on MTU error code of DSB 6 (drive sense byte) (for online diagnostics). Error was found during short forward/backward change of direction.	Refer to MTU Error Code Table (See Section A.2)

Routine number	Error Code	Description	Fault location
51	38	Ready signal was off. Error was found during short forward to backward change of direction.	MTU PCA 1A05, 1A06 operator error
51	41	Tape loop alarm left. Error detected in servo on machine reel side. Error was found during long forward to backward change of direction.	PCA 1A04 in the MTU or capacitive sensor
51	42	Tape loop alarm right. Error detected in servo on file reel side. Error was found during long forward to backward change of direction.	PCA 1A04 in the MTU or capacitive sensor
51	44	Analysis was done by error code of operator panel on MTU (for offline diagnostics). Analysis was done on MTU error code of DSB 6 (drive sense byte) (for online diagnostics). Error was found during long forward to backward change of direction.	Refer to MTU Error Code Table (See Section A.2)
51	48	Ready signal was off.	MTU PCA 1A05, 1A06, or operator error
51	51	Tape loop alarm right. Error detected in servo on machine reel side.	PCA 1A04 in the MTU, or capacitive sensor
51	52	Tape loop alarm right. Error detected in servo on file reel side.	PCA 1A04 in the MTU, or capacitive sensor
51	54	Analysis was done by error code of operator panel on MTU (for offline diagnostics). Analysis was done on MTU error code of DSB 6 (for online diagnostics). Error was found during long go up/down backward run.	Refer to MTU Error Code Table (See Section A.2)
51	58	Ready signal was off. Error was found during long go up/down backward run.	MTU PCA 1A05, 1A06, or operator error

Routine number	Error Code	Description	Fault location
51	61	Tape loop alarm right. Error detected in servo on machine reel side. Error was found during short go up/down backward run.	PCA 1A04 in the MTU or capacitive sensor
51	62	Tape loop alarm right. Error detected in servo on machine reel side. Error was found during short go up/down backward run.	PCA 1A04 in the MTU or capacitive sensor
51	64	Analysis was done by error code of operator panel on MTU (for offline diagnostics). Analysis was done on MTU error code of DSB 6 (for online diagnostics). Error was found during short go up/down backward run.	Refer to MTU Error Code Table (See Section A.2)
51	68	Ready signal was off. Error was found during short go up/down backward run.	MTU PCA 1A05, 1A06, or operator error
52	01	GAPC (gap control) did not reset during backward run.	MTU PCA 1A05 or 1A06
52	02	MTU ready signal was a '0' during forward run.	MTU PCA 1A05 or 1A06
52	03	FMT detected interruption signal from MTU in ready status during forward run.	MTU PCA 1A05 or 1A06
52	04	MTU online signal was a '0' during forward run.	Manual interruption; if no manual action, PCA 1A05 or 1A06 in the MTU
52	05	Tape loop alarm-left, during forward run.	Refer to MTU Error Code Table (See Section A.2)
52	06	TU (tape unit) check occurred during forward run.	Capacitive sensor or PCA "B" on MTU side panel
52	07	Tape loop alarm right during forward run.	Capacitive sensor or PCA "B" on MTU side panel

Routine number	Error Code	Description	Fault location
52	08	Velocity error during forward run.	Tape drive A PCA on MTU side panel, PCA 1A04 in the MTU, or Capstan motor assembly
52	09	Manual action to MTU during forward run.	Operator error
52	10	Tape running direction was incorrect during forward run.	MTU PCA 1A04, 1A05 or 1A06
52	12	Tacho signal was not detected by MTU during forward run.	Interface cable, PCA 1A05, or distribution PCA in the FMT
52	13	Error detected in CPFWD (Capstan forward) signal detection circuit during forward run.	Interface cable, PCA 1A05, or distribution PCA in the FMT
52	21	GAPC (gap control) did not reset during backward run.	MTU PCA 1A05 or 1A06
52	22	MTU ready signal was a '0' during forward run.	MTU PCA 1A05 or 1A06
52	23	FMT detected interrupt signal from MTU in ready status during backward run.	MTU PCA 1A05 or 1A06
52	24	MTU online signal was a '0' during backward run.	Manual interruption; if not manual action, MTU PCA 1A05 or 1A06
52	25	Tape loop alarm left during backward run.	Refer to MTU Error Code Table (See Section A.2)
52	26	TU (tape unit) check occurred during backward run.	Capacitive sensor, or Tape drive B PCA on MTU side panel
52	27	Tape loop alarm right during backward run.	Capacitive sensor, or Tape drive B PCA on MTU side panel
52	28	Velocity error during forward run.	Tape drive A PCA on MTU side panel, PCA 1A04 in the MTU, or capstan motor assembly

Routine number	Error Code	Description	Fault location
52	29	Manual action to MTU during forward run.	Operator error
52	30	Tape running direction was incorrect during backward run.	MTU PCA 1A04, 1A05, or 1A06
52	32	Tacho signal was not detected by MTU during backward run.	Interface cable, PCA 1A05, or distribution PCA in the FMT
52	33	Error detected in CPFWD signal detection circuit during backward run.	Interface cable, PCA 1A05, or distribution PCA in the FMT
53	01	Write current or erase current error in write/erase head.	Write/read PCA, or 532403U
53	03	Defects in MTU read amplifier.	Write/read PCA, or PCA 1A06 in the FMT
53	04	At least 1 bit of dead track was detected (bit 0 - 8).	Write/read PCA, or PCA 1A06 in the FMT
53	05	Tape error. The tape should be changed and this routine repeated. (See explanation of Routine 53 in Section C.5.)	Tape
53	06	Interrupt from MTU by TU (tape unit) check.	Operator error
53	07	Interrupt from MTU.	Operator error
53	31	GAPC signal was not set within the specified period.	Interface cable; MTU PCA 1A05, 1A06, or distribution PCA; or 1A05 in the FMT
53	37	Beginning of tape cannot be detected.	Operator error, beginning of tape sensor
53	8X	TAG control was executed at the specified MTU address but failed.	Check MTU front panel for error code
54	01	MTU interrupt signal was not detected during backward run.	Beginning of tape sensor, or MTU PCA 1A05 or 1A06

Routine number	Error Code	Description	Fault location
54	02	Tape unit check.	Refer to MTU Error Code Table (See Section A.2)
54	03	Manual interruption.	Operator error
54	04	Auto cleaner did not return to normal position.	Auto cleaner
54	05	Temporary error of auto cleaner.	Auto cleaner
54	30	Tacho pulse was not set within the specified period.	Operator error
54	31	GAPC (gap control) signal was not set within the specified period.	MTU PCA 1A05 or 1A06
54	32	MTU capstan motor error detected.	Capstan motor assembly
54	33	D.QTP signal detection circuit error detected.	PCA 1A05 in the FMT
54	34	Tacho A/B signal error detected.	PCA 1A05 in the FMT
54	35	Dynamic reverse was detected.	Tape drive A PCA on MTU side panel, or PCA 1A02 in the MTU
54	36	Tacho A/B signal error detected.	PCA 1A05 in the FMT
54	37	Beginning of tape was not detected.	Beginning tape sensor
54	8X	TAG Control was executed at the specified MTU address but failed.	Check MTU front panel for error code
54	96	Beginning of tape was not detected.	Beginning of tape sensor, or marker
54	98	Online signal was reset during rewind.	Operator error
55	01	Velocity retry count out.	PCA 1A04 in the MTU, tape drive A PCA on MTU side panel, or capstan motor assembly

Routine number	Error Code	Description	Fault location
55	02	Excessive retrys.	Capstan motor assembly
55	04	HNOIS signal was not detected.	Change tape and retry this routine; PCA 1A04 in the MTU, or PCA 1A06 in the FMT
55	05	Velocity change.	PCA 1A04 in the MTU, tape drive A PCA on MTU side panel, or capstan motor assembly
55	06	Slip check was detected.	Capstan roller
55	30	Tacho pulse signal was not detected within the specified period.	Operator error
55	31	CAPC signal was not set within the specified period.	MTU PCA 1A05 or 1A06
55	32	MTU capstan motor error detected.	Capstan motor assembly
55	33	D.QTP signal detection circuit error detected.	PCA 1A05 in the FMT
55	34	Tacho A/B signal error detected.	PCA 1A05 in the FMT
55	35	Dynamic reversal error was detected.	Tape drive A PCA on MTU side panel, or PCA 1A04 in the MTU
55	36	Tacho A/B signal error was detected.	PCA 1A05 in the FMT
55	8X	TAG control was executed at the specified MTU address but failed.	
56	01	Loop alarm-left.	PCA 1A04 in the MTU, or capacitive sensor
56	02	Loop alarm-right.	PCA 1A04 in the MTU, or capacitive sensor
56	04	Air bearing alarm on, miscellaneous error.	Air supply of MTU

Routine number	Error Code	Description	Fault location
56	08	Ready signal was reset.	Operator error
56	11	Stop position at IBC (Inter Block Gap) is not correct.	Capstan motor assembly, tape drive A PCA on MTU side panel, or PCA 1A04 in the MTU
56	13	HNOIS signal was not detected.	Write/read PCA
56	15	Excessive speed change over $\pm 7\%$ of the specified value.	Tape drive A PCA on MTU side panel, or PCA 1A04 in the MTU
56	31	CAPC signal was not set within the specified period.	MTU PCA 1A05 or 1A06
56	32	Capstan motor error detected.	Capstan motor assembly
56	33	D.QTP signal detection circuit error detected.	PCA 1A05 in the FMT
56	34	Tacho A/B signal error detected.	PCA 1A05 in the FMT
56	35	Dynamic reversal error was detected.	Tape drive A PCA on MTU side panel, or PCA 1A04 in the MTU
56	36	Tacho A/B signal error was detected.	PCA 1A05 in the FMT
56	8X	TAG control was executed at the specified MTU address but failed.	
57	01	Velocity retry count out.	PCA 1A04 in the MTU, tape drive A PCA on MTU side panel, or capstan motor assembly
57	02	Excessive retrys.	PCA 1A04 in the MTU, tape drive A PCA on MTU side panel, or capstan motor assembly
57	04	HNOIS signal was not detected.	Change tape and retry this routine. PCA 1A04 in the MTU, or PCA 1A06 in the FMT

Routine number	Error Code	Description	Fault location
57	05	Velocity change.	PCA 1A04 in the MTU, tape drive A PCA on MTU side panel, or capstan motor assembly
57	06	Slip check was detected.	Capstan roller
57	30	Tacho pulse signal was not detected within the specified period.	Operator error
57	31	CAPC signal was not set within the specified period.	MTU PCA 1A05 or 1A06
57	32	MTU capstan motor error detected.	Capstan motor assembly
57	33	D.QTP signal detection circuit error detected.	PCA 1A05 in the FMT
57	34	Tacho A/B signal error detected.	PCA 1A05 in the FMT
57	35	Dynamic reversal error was detected.	Tape drive A PCA on MTU side panel, or PCA 1A04 in the MTU
57	36	Tacho A/B signal error was detected.	PCA 1A05 in the FMT
57	38	Beginning of tape was detected where not expected.	Beginning of tape sensor, or tape
57	8X	TAG control was executed at the specified MTU address but failed.	
57	90	Group coded recording status was not set by command tag operation.	532401U
58	01	Loop alarm-left.	Tape drive B PCA or MTU side panel, or capacitive sensor
58	02	Loop alarm-right.	Tape drive B PCA or MTU side panel, or capacitive sensor

Routine number	Error Code	Description	Fault location
58	04	Air bearing alarm on miscellaneous error.	Air supply of MTU
58	08	Ready signal was reset.	Operator error
58	11	Stop position at IBG (inter block gap) is not correct.	Capstan motor assembly, tape drive B PCA or MTU side panel, or PCA 1A04 in the MTU
58	13	HNOIS signal was not detected.	Write/read PCA
58	15	Excessive speed change over $\pm 7\%$ of the specified value.	Tape drive B PCA or MTU side panel, or PCA 1A04 in the MTU
58	31	CAPC signal was not set within the specified period.	MTU PCA 1A05 or 1A06
58	32	MTU capstan motor error detected.	Capstan motor assembly
58	33	D.QTP signal detection circuit error detected.	PCA 1A05 in the FMT
58	34	Tacho A/B signal error detected.	PCA 1A05 in the FMT
58	35	Dynamic reversal error was detected.	Tape drive B PCA or MTU side panel, or PCA 1A04 in the MTU
58	36	Tacho A/B signal error was detected.	PCA 1A05 in the FMT
58	8X	TAG control was executed at the specified MTU address but failed.	
60	01	Either bit of TSNS (time sense) 0-8 was detected.	Erase head, or cable between erase head and write/read PCA
60	02	Tacho pulse was stopped during erase diagnostics.	Operator error
60	30	Tacho pulse stopped during erase.	Operator error

Routine number	Error Code	Description	Fault location
60	31	GAPC (Gap Control) signal was not detected within the specified period during erase.	MTU PCA 1A05 or 1A06 or operator error
60	8X	TAG control was executed at the specified MTU address but failed.	Check the MTU front panel for an error code
61	30	Tacho pulse stopped during erase.	Operator error
61	31	GAPC signal was not detected within the specified period during erase.	MTU PCA 1A05 or 1A06 or operator error
61	32	Tacho pulse signal was not set within the specified period.	MTU PCA 1A05 or 1A06
61	33	QTP (quarter tach pulse) signal detection error.	MTU PCA 1A05 or 1A06
61	34	Tacho A/B signal error detected.	MTU PCA 1A05 or 1A06
61	35	Dynamic reverse error was detected.	MTU PCA 1A05 or 1A06
61	38	Beginning of tape was detected where signal was not expected.	Beginning of tape sensor or tape
61	61	During WRT (write), suitable place for diagnostics was not found within 15 m from beginning of tape.	Tape error
61	62	During WRT (write), tacho pulse stopped.	Operator error
61	63	Although suitable place for diagnostics was found during WRT (write), a trap was issued from MTU.	Operator error
61	64	During WRT (write), SAGC check error was set incorrectly.	Write/read PCA, MTU PCA 1A05 or 1A06
61	65	SAGC (self adjust gain control) check error was incorrectly set in read mode, although it was not expected.	Write/read PCA

Routine number	Error Code	Description	Fault location
61	66	SAGC check detection circuit error detected.	Write/read PCA
61	67	Although TU (tape unit) interrupt was found, the cause is not SAGC check.	Write/read PCA
61	68	Count of SAGC counter error detected.	Write/read PCA, or MTU PCA 1A05 or 1A06
61	69	Count is preset in SAGC counter, but GSD was not performed in MTU.	Write/read PCA
61	8X	TAG control was executed at the specified MTU address but failed.	Check the MTU front panel for an error code
61	90	GCR (group coded recording) status was not set by command tag operation.	532401U
62	01	Early begin read check was detected.	Write/read PCA or head
62	02	Slow check was detected.	Capacitive sensor
62	03	Start read check was detected.	PCA 1A04 in the MTU, tape drive A PCA on MTU side panel, or PCA 1A04 in the FMT
62	04	While waiting for POSA (postamble) signal, DBOB (detection of beginning of block) signal was reset.	Write/read PCA
62	05	Postamble error was detected.	Write/read PCA
62	06	End data check was detected.	Write/read PCA
62	07	Start read check was detected because tape speed was incorrect.	PCA 1A04 in the MTU, or tape drive A PCA on MTU side panel
62	08	Tape speed was incorrect when postamble signal was reported.	PCA 1A04 in the MTU, or tape drive A PCA on MTU side panel

Routine number	Error Code	Description	Fault location
62	21	Tacho stop signal was set.	Operator error
62	22	Tape error. The tape should be changed and this routine should be repeated.	Operator error
62	23	BCY signal was not set.	PCA 1A05 in the FMT
62	26	BIBSY (bus in busy) signal was not reset.	PCA 1A07 in the FMT
62	30	Tacho pulse stopped during erase.	Operator error
62	31	GAPC (gap control) signal was not detected within the specified period during erase.	MTU PCA 1A05 or 1A06 or operator error
62	32	Tacho pulse signal was not set within the specified period.	MTU PCA 1A05 or 1A06
62	33	QTP (quarter tach pulse) signal detection error.	MTU PCA 1A05 or 1A06
62	34	Tacho A/B signal error detected.	MTU PCA 1A05 or 1A06
62	35	Dynamic reverse error was detected.	MTU PCA 1A05 or 1A06
62	38	Beginning of tape was detected where signal was not expected.	Beginning of tape sensor, or tape
62	40	Deskewing buffer check was detected.	PCA 1A02 in the FMT
62	41	Skew error was detected.	PCA 1A02 in the FMT
62	42	Drop out error was detected.	PCA 1A02 in the FMT
62	43	VRC (vertical redundancy check) error was detected.	PCA 1A02 in the FMT
62	44	Multi-track error was detected.	PCA 1A02 in the FMT
62	45	Postamble error was detected.	PCA 1A02 in the FMT
62	46	Write trigger VRC (vertical redundancy check) error was detected.	PCA 1A02 in the FMT

Routine number	Error Code	Description	Fault location
62	47	Write bus out check was detected.	PCA 1A06 or 1A07 in the FMT
62	48	Over-run error (in offline mode only) was detected.	PCA 1A06 or 1A07 in the FMT
62	54	Transfer in, register parity error was detected.	PCA 1A06 or 1A07 in the FMT
62	55	CRCA-CRCB error was detected.	PCA 1A06 in the FMT
62	56	FMT detected bus parity error in controller interface.	PCA 1A07 in the FMT
62	61	During the write (WRT) mode, a suitable place for diagnostics was not found within 15 m from beginning of tape.	Tape error
62	62	During the write (WRT) run, tach pulse stopped.	Operator error
62	63	Although a suitable place for diagnostics was found during the write (WRT) mode, a trap was issued from MTU.	Operator error
62	64	During the write (WRT) mode, SAGC (self adjust gain control) check error was set incorrectly.	Write/read PCA, or MTU PCA 1A05 or 1A06
62	8X	TAG control was executed at the specified MTU address but failed.	Check MTU front panel for error code
62	90	GCR (group coded recording) status was not set by command tag operation.	532401U
63	01	Early begin read check was detected.	Write/read PCA, or head
63	02	Slow check was detected.	Capacitive sensor
63	03	Start read check was detected.	PCA 1A04 in the MTU, tape drive A PCA in MTU side panel, or PCA 1A04 in the FMT

Routine number	Error Code	Description	Fault location
63	04	While waiting for POSA (postamble) signal, DBOB (detected beginning of block) signal was reset.	Write/read PCA
63	21	Tacho stop signal was set.	Operator error
63	22	Tape error. The tape should be changed and this routine should be repeated.	Operator error
63	23	BCY signal was not set.	PCA 1A05 in the FMT
63	26	BIBSY (bus in busy) signal was not reset.	PCA 1A07 in the FMT
63	30	Tacho pulse stopped during erase.	Operator error
63	31	GAPC (gap control) signal was not detected within the specified period during erase.	MTU PCA 1A05 or 1A06 or operator error
63	41	Skew error was detected.	PCA 1A02 in the FMT
63	42	Drop out error was detected.	PCA 1A02 in the FMT
63	43	VRC (vertical redundancy check) error was detected.	PCA 1A02 in the FMT
63	44	Multi-track error was detected.	PCA 1A02 in the FMT
63	45	Postamble error was detected.	PCA 1A02 in the FMT
63	46	Write trigger VRC (vertical redundancy check) error was detected.	PCA 1A06 in the FMT
63	47	Write bus out check was detected.	PCA 1A06 or 1A07 in the FMT
63	48	Over-run error (in offline mode only) was detected.	PCA 1A06 or 1A07 in the FMT
63	54	Transfer in, register parity error was detected.	PCA 1A06 or 1A07 in the FMT
63	55	Cyclic Redundancy Check A and B (CRCA-CRCB) error was detected.	PCA 1A06 in FMT

Routine number	Error Code	Description	Fault location
63	56	FMT detected bus parity error in the host controller interface.	PCA 1A07 in the FMT, or Controller
63	8X	TAG control was executed at the specified MTU address but failed.	Check MTU front panel for error code
64	01	Tacho signal was stopped during waiting first data.	Operator error
64	02	Tacho signal was stopped during waiting LRC.	Operator error
64	03	NOIS (Noise) signal was set.	Write/read PCA, or head
64	20	Velocity retry excessive.	PCA 1A04 in the MTU, or tape drive A PCA on MTU side panel
64	21	Tacho signal was stopped.	Operator error
64	22	Tape error. The tape should be changed and this routine should be repeated.	Tape
64	23	BCY signal was not set.	PCA 1A05 in the FMT
64	26	BIBSY (bus in busy) signal was not reset.	PCA 1A07 in the FMT
64	30	Tacho pulse stopped during erase.	Operator error
64	31	GAPC (gap control) signal was not detected within the specified period during erase.	MTU PCA 1A05 or 1A06, or operator error
64	41	Skew error was detected.	PCA 1A01 in the FMT
64	46	Write trigger VRC (vertical redundancy check) error was detected.	PCA 1A06 in the FMT
64	47	Write bus out check was detected.	PCA 1A06 or 1A07 in the FMT

Routine number	Error Code	Description	Fault location
64	48	Over-run error (in offline mode only) was detected.	PCA 1A06 or 1A07 in the FMT
64	51	VRC (vertical redundancy check) error in nonreturn to zero I mode was detected.	PCA 1A01 in the FMT
64	52	LRC (longitudinal redundancy check) error was detected.	PCA 1A01 in the FMT
64	54	Transfer in, register parity error was detected.	PCA 1A06 or 1A07 in the FMT
64	55	CRCA-CRCB (cyclic redundancy check A and B) error was detected.	PCA 1A06 in the FMT
64	56	FMT detected bus parity error in the host controller interface.	PCA 1A07 in the FMT, or host controller
64	8X	TAG control was executed at the specified MTU address but failed.	
64	98	Manual interrupt to MTU.	Operator error
65	10	Tape error. Change tape and retry this routine.	Tape
65	21	Manual interruption.	Operator error
65 (or)	30	Complete read signal was not detected at slice level 15%.	Amplitude setting of write/read PCA
65	30	Tacho pulse stopped during erase.	Operator error
65	31	GAPC signal was not detected within the specified period during erase.	MTU PCA 1A05, 1A06, or operator error
65	38	Beginning of tape was detected where not expected.	Beginning of tape sensor, or tape
65	50	Complete read signal was not detected at slice level 41%.	Amplitude setting of write/read PCA
65	70	Complete read signal was not detected at slice level 51%.	Amplitude setting of write/read PCA

Routine number	Error Code	Description	Fault location
65	8X	TAG control was executed at the specified MTU address but failed.	
65	90	Complete read signal was not detected at slice level 64%.	Amplitude setting of write/read PCA
65	96	Beginning of tape was not detected.	Operator error
65	98	Manual interruption during rewinding.	Operator error
66	01	IBG (Inter Block Gap) length is too long in phase encode mode.	MTU PCA 1A05, 1A06, or dirty tape path
66	02	IBG length is too short in phase encode mode.	MTU PCA 1A05, 1A06, or dirty tape path
66	03	IBG length is too long in group coded recording mode.	MTU PCA 1A05, 1A06, or dirty tape path
66	04	IBG length is too short in group coded recording mode.	MTU PCA 1A05, 1A06, or dirty tape path
66	21	Manual interruption.	Operator error.
66	22	Tape error. Change tape and retry this routine.	Tape
66	30	Tacho pulse stopped during erase.	Operator error
66	31	GAPC signal was not detected within the specified period during erase.	MTU PCA 1A05, 1A06, or operator error
66	38	Beginning of tape was detected where not expected.	Beginning of tape sensor, or tape
66	8X	TAG control was executed at the specified MTU address but failed.	Check MTU front panel for error code
66	90	Group coded recording status not set by command tag operation.	532401U
66	96	Beginning of tape was not detected.	Operator error

Routine number	Error Code	Description	Fault location
66	98	Tape error. Change the tape and retry.	Tape
70	01	Excessive feed through signal was detected.	Write/read head
70	21	Manual interruption.	Operator error
70	22	Tape error. Change the tape and retry.	Tape
70	38	Beginning of tape detected where not expected.	Beginning of tape sensor, or tape
70	8X	TAG control was executed at the specified MTU address but failed.	Check MTU front panel for error code
70	90	Group coded recording status cannot be set by command tag operation. After rewind end, tape is not at beginning of tape.	Operator error
70	96	Group coded recording status cannot be set by command tag operation. After rewind end, tape is not at beginning of tape.	Operator error
70	98	Manual operation error.	Operator error
71	01	Excessive cross-talk signal was detected.	Write/read head
71	22	Tape error. Change the tape and retry.	Tape
71	38	Beginning of tape detected where not expected.	Beginning of tape sensor, or tape
71	8X	TAG control was executed at the specified MTU address but failed.	Check MTU front panel for error code
71	96	Group coded recording status cannot be set by command tag operation. After rewind end, tape is not at beginning of tape.	Operator error

Routine number	Error Code	Description	Fault location
71	98	Manual operation error.	Operator error
73	01	WTM (write tape mark command) retry excessive in phase encode mode.	Write/read PCA
73	02	Manual interrupt (reset key).	Operator error
73	03	Drop out error.	Write/read PCA
73	2X	REJECT error was detected in command 1 through 8 (see footnote 1).	MTU PCA 1A05, 1A06, write/read PCA, or PCA 1A06 in the FMT
73	3X	Excessive velocity change during write operation.	PCA 1A04 in the MTU, or tape drive A PCA on MTU side panel
73	4X	Start read check was detected.	Capstan motor assembly or PCA 1A04 in the FMT
73	5X	PREC (partial record), EDC (end data check) check was detected.	Capstan motor assembly or PCA 1A04 in the FMT
73	6X	Multi-track error was detected.	Capstan motor assembly or PCA 1A04 in the FMT
73	7X	VRC (vertical redundancy check) and CRC (cyclic redundancy check) skew error was detected.	Write/read PCA, head, or PCA 1A06 in the FMT
73	05	IDBCK was detected.	Write/read PCA or head
73	06	Beginning of tape was detected during backward operation.	Tape error, or auto cleaner
73	07	OVRN (not overrun) was detected during offline diagnostics.	PCA 1A07 in the FMT
74	01	WTM (write tape mark command) retry excessive in phase encode mode.	Write/read PCA
74	02	Manual interruption (reset key).	Operator error

1 1=BSP, 2=FSPP, 3=SP, 4=RD, 5=BRD, 6=WRT, 7=WIM, 8=ERS

Routine number	Error Code	Description	Fault location
74	03	Drop out error.	Write/read PCA
74	2X	REJECT error was detected in command 1 through 8 (see footnote 1).	MTU PCA 1A05, 1A06 Write/read PCA, or PCA 1A06 in the FMT
74	3X	Excessive velocity change during write operation	PCA 1A04 in the MTU, or tape drive A PCA on MTU side panel
74	4X	Start read check was detected	Capstan motor assembly, or FMT PCA 1A04
74	5X	PREC, EDC check was detected.	Capstan motor assembly, or FMT PCA 1A04
74	6X	Multi-track error was detected	Capstan motor assembly, or FMT PCA 1A04
74	7X	VRC, CRC, skew error was detected.	PCA 1A02 or 1A06 in the FMT
74	05	IDBCK (ID burst check) was detected.	Write/read PCA, or head
74	06	Beginning of tape was detected during backward operation.	Tape error, or auto cleaner
74	07	OV RN (not overrun) was detected during offline diagnostics.	PCA 1A07 in the FMT
75	01	WTM (write tape mark) retry excessive in phase encode mode.	Write/read PCA
75	02	Manual interruption (reset key).	Operator error
75	2X	REJECT error was detected in command 1 through 8 (see footnote 1.)	MTU PCA 1A05, 1A06, Write/read PCA, or PCA 1A06 in the FMT
75	3X	Excessive velocity change during write operation.	PCA 1A04 in the MTU, or tape drive A PCA on MTU side panel
75	7X	VRC (vertical redundancy check) CRC (cyclic redundancy check) skew error was detected.	PCA 1A01 or 1A05 in the FMT

1 1=BSP, 2=FSPF, 3=SP, 4=RD, 5=BRD, 6=WRT, 7=WIM, 8=ERS

Routine number	Error Code	Description	Fault location
75	06	Beginning of tape was detected during backward operation.	Tape error, or auto cleaner
75	07	OV RN (not overrun) was detected during offline diagnostics.	PCA 1A07 in the FMT
79	01	SLTAG (select TAG) signal was not set correctly.	PCA 1A05 in the FMT
79	02	Inconsistency between FMT and distribution PCA.	Cable between PCA 1A05 and distribution PCA in the FMT
79	03	TAGI signal was not set.	MTU interface cable
79	04	MTU ready signal or online signal was not set.	532403U
79	05	DVENB (device enable) signal was not set.	FMT distribution PCA
79	06	DVBSY (device busy) signal was not set.	FMT distribution PCA
79	07	LWR (loop write read) FMT signal was not set correctly.	PCA 1A05 in the FMT
79	08	DBMPX (device bus multiplex) signal was not set correctly.	PCA 1A05 in the FMT
79	09	Error detected at interface bus when LWR FMT mode was set, or error detected in DBMPX function.	PCA 1A05 in the FMT
79	10	Error was detected at interface bus when LWR FMT mode was set (P bit).	PCA 1A05 in the FMT
79	11	Error detected at interface bus when LWR FMT mode was set (P bit), or error detected in DBMPX function.	532403U, MTU interface cable, or FMT distribution PCA
79	12	Sense tag was not set correctly.	PCA 1A05 in the FMT
79	13	MPXBO (multiplex bus out) signal was not set correctly.	PCA 1A05 in the FMT

Routine number	Error Code	Description	Fault location
79	14	LWR FMT or DBMPX (device bus multiplex signal error.	PCA 1A05 in the FMT
79	15	Online and ready signal is always set in MTU.	532403U
79	16	MTU indicates operation possible at all times.	532403U
79	17	Interface cables between FMT and MTU connected incorrectly, or the diagnostics MTU address was specified by mistake.	Cable connection, or address mistake
79	18	Although SLTAG (select TAG) signal is reset, operation possible was posted.	Distribution PCA in the FMT
80	37	Although interrupt signal from MTU was detected, beginning of tape was not detected.	Operator error
80	38	Beginning of tape was detected when not expected.	Operator error
80	8X	TAG control was executed at the specified MTU address but failed.	Check MTU front panel for error code
80	WW	WW is defined as follows: BWD: WW 63 through 72 means capstan needs alignment. FWD: WW 43 through 54 means azimuth needs adjustment. WW indicates quantity of skew for each error code is shown below. (See Section K for checks and adjustments.)	
		Error code	Quantity of skew
		FWD	BWD
		43	63
		44	64
		45	65
		46	66
		47	67
		50	70
		51	71
		52	72
		53	
		54	
			50
			46
			42
			38
			33
			29
			25
			21
			17
			13

Routine number	Error Code	Description	Fault location
83	01	Manual interruption occurred while executing this routine.	Operator error
83	10	Read amplifier setting was too low and requires adjustment	Read amplifier adjustment
83	11	Read amplifier setting was too low and requires adjustment	Read amplifier adjustment
83	90	Group code recording status was not set by command tag operation.	532401U
90	8X	TAG control was executed at the specified MTU address but failed.	Check MTU front panel for error code
91	01	Although the device sense was executed, the response signal (TAGI signal) was not set.	Distribution PCA in the FMT
(or)			
91	01	Online signal was reset during execution of DSE (data security erase) command.	Operator error
91	8X	TAG control was executed at the specified MTU address but failed.	Check MTU front panel for error code
91	96	Beginning of tape marker was not detected during rewind.	Operator error, or beginning of tape sensor
91	98	Online signal was reset by rewind.	Operator error
92	YY	The code number YY shows the result of counting the number of data checks until the detection of tape mark. The number is decimal.	
93	37	Beginning of tape was not detected during backward mode.	Operator error, or beginning of tape sensor

Routine number	Error Code	Description	Fault location
93	YY	The code number YY indicates the number of data checks when write operation is executed in group coded recording from beginning to end of tape. The number is decimal.	
94	YY	The code number YY indicates the number of data checks when the write operation is executed in phase encode mode from beginning of tape to end of tape. The number is decimal.	
95	YY	The code number YY indicates the number of data checks when the write operation is executed in nonreturn to zero I mode from beginning of tape to end of tape.	
96	37	Beginning of tape was not detected during backward mode.	Operator error, or beginning of tape sensor
(or)			
96	37	Beginning of tape could not be detected.	Operator error BOT sensor
96	8X	TAG control was executed at the specified MTU address but failed.	Check the MTU front panel for an error code
97	01	Manual interruption during space to end of tape.	Operator error
97	8X	TAG control was executed at the specified MTU address but failed.	Check the MTU front panel for an error code
98	01	MP (microprogram) halt was indicated during ROM SCAN operation but MP CONTROL FLAG (STEP) was not set correctly.	PCA 1A08 in the FMT, or diagnostics panel
98	02	MP halt was indicated, but halt bit was not set correctly (bit 10).	PCA 1A08 in the FMT, or diagnostics panel
98	03	ROM SCAN (\$E4, CNT) is indicated, but MP controller flag was not set correctly (bit 5).	PCA 1A08 in the FMT, or diagnostics panel

Routine number	Error Code	Description	Fault location
98	04	Parity error was detected during ROM SCAN operation, PERR (parity error) bit was set (bit 11).	PCA 1A07 in the FMT
98	05	MP halt was indicated, but MP controller FLAG (STEP) was not set correctly.	PCA 1A08 in the FMT
98	06	MP halt was indicated, but halt bit was not set correctly (bit 10).	PCA 1A08 in the FMT
98	07	MP halt mode was not reset.	PCA 1A08 in the FMT, or diagnostics panel
98	08	ROM scan mode was not reset.	PCA 1A08 in the FMT, or diagnostics panel
98	39	MP halt was indicated during ROM SCAN mode and MP halt mode was not set.	PCA 1A08 in the FMT
99	01	Lamp test was incorrect in power on RST routine.	PCA 1A08 in the FMT, or diagnostics panel
99	02	PHLT (processor halt) bit was ON in idle, or cable was disconnected.	Cable between panel
99	03	FMT detected error in POWDIA check.	PCA 1A02, 1A05, 1A06, or 1A08 in the FMT
99	04	CS (control storage) parity error was detected.	PCA 1A08 in the FMT
99	05	Register parity error was detected.	PCA 1A01, 1A02, 1A05, 1A06, 1A07, or 1A08 in the FMT
99	06	M PERR (parity error) bit on, but no CS (control storage) or register parity error existed.	PCA 1A07 in the FMT
99	11	Address compare (\$CX, CNT) function was not performed.	PCA 1A08 in the FMT

Routine number	Error Code	Description	Fault location
99	12	MP (microprogram) control (\$EX, CNT) function was not performed.	PCA 1A08 in the FMT
99	22	FMT was not set to diagnostics mode, but offline bit was not set.	PCA 1A08 in the FMT, or diagnostics panel
99	23	When setting FMT to diagnostics mode, busy bit was on.	PCA 1A07 in the FMT
99	24	FMT was set to diagnostics mode, but M PHLT (processor halt) bit was on.	PCA 1A08 in the FMT
99	25	FMT was set to diagnostics mode, but CUPER (control storage parity error) bit was on.	PCA 1A07 in the FMT
99	26	FMT was set to diagnostics mode, but register parity error bit was on.	PCA 1A08 in the FMT
99	27	Routine number was not set correctly.	PCA 1A08 in the FMT, or diagnostics panel
99	28	TU (tape unit) address was not set correctly.	PCA 1A08 in the FMT, or diagnostics panel
99	29	Diagnostics command was issued, but duty on timed out.	PCA 1A02, 1A06, 1A07, or 1A08 in the FMT
99	40	After FMT was set to diagnostics mode, busy signal was set, but diagnostics condition flag within FMT was not set.	PCA 1A08 in the FMT
99	41	BUSY bit was off, but IBUSY bit was on.	PCA 1A08 in the FMT
99	42	BUSY bit was on, but IBUSY bit was off.	PCA 1A07 in the FMT
99	43	After diagnostics routine was started, MPHLT was detected.	PCA 1A08 in the FMT

Routine number	Error Code	Description	Fault location
99	51	Error flag was on at diagnostics end, but error code is all 0.	PCA 1A08 in the FMT
99	59	Error flag was off at diagnostics end, but error code was all 0.	PCA 1A08 in the FMT
99	61	IM test error in power on test routine for diagnostics panel	PCA 1A08 in the FMT, or diagnostics panel
99	62	Microprogram of diagnostics panel is in error.	Diagnostics panel
99	99	Diagnostics was initiated at the specified MTU address and failed because MTU is in not-ready status.	If MTU is ready, run Routine 79. Routines 10, 11, 12, 14, and 15 can run even if the MTU is in not-ready status, but the MTU should be powered on. FMT checks TAG in signal response.
FF	FF	Routine number error (occurs with online diagnostics or field tester only).	Indicated routine number was not 00 through 99

C.5 Routine Description

This section provides a description of the routines for both FMT and MTU offline and online diagnostics. The description of each routine includes:

- (1) The routine number and title. Routines are listed in numerical order from 00 to 99.
- (2) The conditions that are required for that routine, if applicable.
- (3) A summary of error codes for that routine.
- (4) A description of what the routine diagnoses and how it functions.

In general, during the execution of a given routine, lamp 1 on the field tester panel will remain on. When the routine is completed or terminated for any reason, lamp 1 will go off. If an error was detected, lamp 8 will go on. To determine the routine number and error code number:

- (1) Set the field tester switches S0 through S7 to \$35, and then toggle the CNT switch.
- (2) The routine number is displayed on the field tester lamps in hex notation.
- (3) Set the field tester switches S0 through S7 to \$36, and toggle the SSS switch.
- (4) The error code is displayed on the field tester lamps in hex notation.
- (5) Consult section C.4, Error Code Table and Fault Isolation, for the appropriate error code.
- (6) Consult the following list for a more detailed description of the routine itself.

Routine 00: Test All Diagnostic Routines.

Conditions:

Host controller can be powered off even if interface cables are connected.

Error Codes:

- | | | |
|----|----|---|
| 78 | 00 | All applicable routines listed in Section C.4 (routines 10 to 78) were tested, and there were no errors. |
| XX | YY | Error was detected in routine XX, and its error code is YY. |
| 99 | XX | The Test All Diagnostics routine implementation was not successful. Refer to the Error Code Table in Section C.4. |

Routine 00: Test All Diagnostic Routines. (continued)

General Description:

- o Routines 10 through 78 listed in Section C.4 are executed sequentially. Undefined routine numbers are skipped.
- o If the addressed MTU is a dual-density model, the diagnostic routine for the 800 rpi mode is skipped.
- o When an error is detected, the program terminates at that routine. Lamp L8 on the field tester lights, and the error code is stored in the FMT register. The error code can be read using the field tester.

Routine 01: Test All Routines (Host Controller Power On).

Conditions:

If interface cables between the formatter and host controller are connected, the host controller power must be turned on. Some routines test the bi-directional data bus of the controller interface by routing data from the driver (DV) to the receiver (RV). If the controller is not pulled up by +5V, the signal level of the data bus cannot be pulled up to high level. This would invalidate the test.

Error Codes:

- | | | |
|----|----|---|
| 78 | 00 | All applicable routines listed in Section C.4 (routines 10 to 78) were tested, and there were no errors. |
| XX | YY | Error was detected in routine XX, and its error code is YY. |
| 99 | XX | The Test All Diagnostics routine implementation was not successful. Refer to the Error Code Table in Section C.4. |

General Description:

- o Routines 10 through 78 listed in Section C.4 are executed sequentially. Undefined routine numbers are skipped.
 - o The byte count to be written in LWR (loop write read) or normal WRT (write) routines is longer than routine 00. The block length of LWR or normal WRT routine in routine 01 is up to 4K bytes, but in routine 00 it is only 55 bytes.
 - o Execution time for each model:

50 ips DD	4 minutes, 43 seconds
50 ips TD	4 minutes, 54 seconds
75 ips DD	5 minutes, 00 seconds
75 ips TD	5 minutes, 08 seconds
125 ips DD	5 minutes, 28 seconds
- Execution time may be longer, depending on the tape used.

Routine 10: Microprocessor Self Test Diagnostics.

Error Codes:

10 00 No error in FMT microprogram.
10 77 Microprocessor error detected.
00 97 MTU is not operational.

General Description:

This test program checks correct performance of all commands of the FMT processor by means of condition code just before and after command execution and some changes in local memory.

Explanation:

Local memory used are registers W0, W1, SB14, and SB15. EXR is not used. The tests are applied in the following order:

- (1) Unconditional branch \$0000 - \$0001
 \$0003 - \$1FF0
 \$1FFX - \$0005
- (2) Branch on condition
- (3) Test bit branch
- (4) Exclusive-OR
- (5) Plus
- (6) Minus
- (7) Branch on condition indirect
- (8) Call on condition
- (9) Register operation
- (10) OR, AND, etc.
- (11) Test bit call
- (12) Move half indirect
- (13) Move full indirect
- (14) Branch indirect
- (15) Call indirect
- (16) Branch on condition indirect.

Routine 11: LSR (Local Storage Register) Test Partial.

Error Codes:

11 00 Local storage memory can be sensed and selection of local storage is confirmed.
11 XX An error was detected in register selection circuit, write bus, or read bus of LSR.
00 97 MTU is not operational.

Routine 11: LSR (Local Storage Register) Test Partial. (continued)

General Description:

One local memory address is selected and all "0" and all "1" data is written into RAM. By reading local memory data, the write bus and read bus around LSR RAM is confirmed. The local memory address is then changed and the test is repeated at the new address. In this way, the register select lines are checked W0 - W7 (address \$10 - \$17). When run in offline diagnostics, this routine runs normally even if the MTU is in a power-on state and has a not-ready status.

Routine 12: Local Memory Read/Write/Test.

Error Codes:

- 12 00 All local storage RAM (64 bytes) in the FMT is tested and no error was detected.
- 12 XX Error is detected in the RAM.
- 00 97 MTU is not operational.

General Description:

- o All "1's" are written in LM (local memory). When all "1's" are sensed, then all "0's" are written in. If all "0's" are sensed, "0's" are checked. The data of LM, which must be stored in FMT, is saved in LM whose data has been confirmed.
- o When run in offline diagnostics, this routine runs normally even if the MTU is in a power-on state and has a not-ready status.

Routine 14: External Register Write and Sense Bus Test.

Conditions:

FMT microprocessor self-test diagnostic routine has been executed without error.

Error Codes:

- 14 00 Basic execution of read/write to external register in routine has no error.
- 14 XX Error detected.
- 00 97 MTU is not operational.

General Description:

- o Selects registers that can be sensed by the FMT microprocessor. Register select circuit, register write clock, write bus, and read bus are checked.
- o When run in offline diagnostics, the routine runs normally even if the MTU is in a power-on state and has a not-ready status.

Routine 14: External Register Write and Sense Bus Test. (continued)

Tests are applied with the following order:

- (1) Register address \$40 through \$4F
- (2) PCA 1A08 in the FMT
- (3) PCA 1A07 in the FMT
- (4) PCA 1A06 in the FMT
- (5) PCA 1A02 in the FMT
- (6) PCA 1A01 in the FMT
- (7) PCA 1A05 in the FMT.

Routine 15: Timer Function Test.

Error Codes:

- | | | |
|----|----|--|
| 15 | 00 | Basic function of the FMT microprogram counter FMT is confirmed. |
| 15 | XX | Error detected. |
| 00 | 97 | MTU is not operational. |

General Description:

- o When the hardware timer (16 bits) for the FMT microprogram is in the clock count mode, function of timer over flow and counter preset is checked.
- o When run in offline diagnostics, the routine runs normally even if the MTU is in a power-on state and has a not-ready status.

Routine 20: Diagnostic Program of Controller Interface Printed Circuit Assembly - 1.

Error Codes:

- | | | |
|----|----|--|
| 20 | 00 | Diagnostics successfully completed with no errors. |
| 20 | XX | Error detected. |

General Description:

- o After writing test patterns into all registers and register files that can be read/written, this routine confirms that the pattern is sensed.
- o For registers that cannot be written, this routine confirms data comparison within this routine.
- o Before this routine, data comparison of data bus and tag control between MTUs and the formatter has not been confirmed.
- o BMX registers \$50 through \$57 are tested only in online diagnostics.

Routine 21: Diagnostic Program of Controller Interface Printed Circuit Assembly - 2.

Error Codes:

- 21 00 Diagnostics successfully completed with no errors.
- 21 XX Error detected.

General Description:

- o This routine is the same as Routine 20 during diagnostics.
- o There are some differences in the offline mode; for example: SSC and TREQ signal are also tested in this routine.
- o This routine does not check register bits that cannot be turned on/off while formatter is in an online status.

Routine 22: Diagnostic Program of MTU Interface Printed Circuit Assembly.

Error Codes:

- 22 00 Diagnostics successfully completed with no errors.
- 22 XX Error detected.

General Description:

- o After writing test pattern in registers that can be read/written, this routine confirms that the pattern can be sensed.
- o This routine confirms timer controls and repositioning counter control bits.

Routine 23: Routine to Confirm MTU Selection.

Error Codes:

- 23 00 Diagnostics successfully completed with no errors.
- 23 XX Error detected.

General Description:

- o This routine checks all connected MTUs used by the FMT.
- o MTU selection logic is checked by using a communication register in the MTU. First bit 4 of communication register 1 in addressed MTU is set. Then, this routine checks that bit 4 of all other MTUs is off.

Routine 24: FMT/MTU Data Bus Test.

Error Codes:

- 24 00 Diagnostics successfully completed with no errors.
- 24 0X Data bus error.
- 24 8X Tag control error.

General Description:

- o This routine confirms that the MTU can be set to loop write/read status. If confirmed, the data bus between the formatter and MTU is checked using test patterns.

Routine 25: Tacho Pulse Signals Test.

Error Codes:

- 25 00 Diagnostics successfully completed with no errors.
- 25 XX Error detected.

General Description:

- o After moving tape, this routine diagnoses the sequence of QTP and FTP, the number of pulse signals, and tach stop detection.

Routine 26: Tape Speed Detection Circuit Test.

Error Codes:

- 26 00 Diagnostics successfully completed with no errors.
- 26 XX Error detected in the speed detection circuit.
- 26 8X Tag control error detected.

General Description:

- o This routine moves the tape and verifies that no error exists in the gap control signal, speed detection, and speed change detection.

Routine 28: Repositioning Counter and Counter Control Function.

Error Codes:

- 28 00 Diagnostics successfully completed with no errors.
- 28 XX Error detected.
- 28 8X Tag control error detected.

General Description:

This routine moves the tape and confirms the following:

- o The repositioning counters operate normally when the DFTP (diagnostic function tape positioning) signals are set.
- o Carry bits are set at the correct timing.
- o Carry bits and repositioning counters are reset.

Routine 29: Trap Circuit Test.

Error Codes:

- 29 00 Diagnostics routine successfully completed with no errors.
- 29 XX Error detected.

General Description:

(1) Timer trap test

This routine sets the timer in the FMT to start while in a trap suppressed status. The check timer trap (T.TMR) signal is set within a fixed time, and checks that a trap is not issued.

(2) Tacho pulse trap test

This routine moves the tape forward, while in a trap suppressed status. (Trap mask bit and tacho stop gate signal are set, but tacho stop trap mask bit is reset.)

(3) MTU interrupt test

While in trap suppressed status, this routine moves the tape backward until the beginning of the tape is detected. The routine then checks that the device interrupt signal is asserted and that the microprogram is not trapped.

Routine 30: FMT Large-Scale Integration Scan Test.

Error Codes:

- 30 00 Diagnostics successfully completed with no errors.
- 30 0X Error detected in large-scale integration circuits of write formatter.
- 30 1X Error detected in large-scale integration circuits of read formatter.

General Description:

This routine applies data scan to the large-scale integration used in the write formatter and read formatter, and confirms that all large-scale integration flip-flops operate normally.

Routine 31: Time Sense and Block Format Decoder Test.

Error Codes:

- 31 00 Diagnostics successfully completed with no errors.
- 31 0X Error detected in the time sense diagnostics (MP [microprogram] mode).
- 31 1X Error detected in the time sense diagnostics (ALLIW [all "1's" write] mode).
- 31 2X Error detected in the block format diagnostics (read status).

Routine 31: Time Sense Block Format Decoder Test. (Continued)

General Description:

- o After setting the formatter to loop write/read FMT mode, this routine repeats on/off motion of a specified pattern in DVBO (device bus out) register for a specified period of time. Then the routine confirms that time sense of all the bits are set. After a series of on/off repetitions, the routine confirms that time sense signals of all bits are reset.
- o Next, this routine confirms that time sense signals are normally set/reset by means of an all "1\$" write function.
- o Keeping the formatter in loop write/read FMT mode, this routine loops noise, block, and tape patterns for a given period, and confirms normal detection of the pattern and of the phase O.K. signals.

Routine 32: Loop Write/Read FMT Phase Encode Test.

Error Codes:

- 32 00 No error detected during loop write/read operation.
- 32 XX Data check or other error was detected.

General Description:

- o This routine executes loop write/read operation in the phase encoded mode, and checks that no error occurs and that the FMT function works normally.
- o All variable frequency oscillator (VFO) tape speeds (50, 75, and 125 ips) are tested. Data is random, and block length is 4K bytes. When this routine is executed in Routine 00, block length is 55 bytes.

Routine 33: Loop Write/Read FMT Group Coded Recording Mode.

Error Codes:

- 33 00 Diagnostics routine successfully completed with no errors.
- 33 XX Error detected.

General Description:

- o Same test as Routine 32 except for density mode.
- o Routine performs tests in the group coded recording mode.

Routine 34: Loop Write/Read FMT Nonreturn to Zero I Mode.

Error Codes:

- 34 00 Diagnostics routine successfully completed with no errors.
- 34 XX Error detected.

General Description:

- o Same test as Routine 32 except for density mode.
- o Routine performs tests in the nonreturn to zero I mode. If the nonreturn to zero I read printed circuit assembly 1A01 is not installed in the FMT, this routine is bypassed.

Routine 35: Loop Write/Read TU Interface Phase Encode Mode.

Error Codes:

- 35 00 Diagnostics routine successfully completed with no errors.
- 35 XX Error detected.

General Description:

- o This routine is the same as Routine 32 except for the loop position of write data.
- o Loop write/read (LWR) tape unit (TU) interface operation in the phase encode mode.
- o In this operation, write data loop is performed at DV/RV of the MTU logic printed circuit assembly.

Routine 36: Loop Write/Read TU Interface Group Coded Recording Mode.

Error Codes:

- 36 00 Diagnostics routine successfully completed with no errors.
- 36 XX Error detected.

General Description:

- o This routine is the same as Routine 35 except that the mode is group coded recording.

Routine 37: Loop Write/Read TU Interface Non return to Zero I Mode.

Error Codes:

- 37 00 Diagnostics routine successfully completed with no errors.
- 37 XX Error detected.

General Description:

- o This routine is the same as Routine 35 except that the mode is nonreturn to zero I.

Routine 38: Loop Write/Read Read/Write Amplifier Phase Encode Mode.

Error Codes:

- 38 00 Diagnostics routine successfully completed with no errors.
- 38 XX Error detected.

General Description:

- o The write-to-read read/write amplifier operation is performed in the phase encode mode.
- o Tape speed depends on the specific MTU model, and the test is performed in normal speed only. Data is random.
- o If the test is executed in Routine 00, block length is 55 bytes.
- o If the test is executed in Routine 01 or Routine 38, block length is 4k bytes.

Routine 39: Loop Write/Read Read/Write Amplifier Group Coded Recording Mode.

Error Codes:

- 39 00 Diagnostics routine successfully completed with no errors.
- 39 XX Error detected.

General Description:

- o Same test as Routine 38 except for execution mode.
- o First the tape is moved from beginning of tape and, for the MTU inner status, is set to group coded recording.
- o Then, the loop read/write operation is executed in the group coded recording mode.

Routine 40: Error Correction Logic-Phase Encode Mode.

Error Codes:

- 40 00
Error correct function operates normally.
- 40 XX
Error is detected in error correction circuit.

General Description:

- o Masking one track, this routine executes the loop-write/read FMT operation (same as Routine 32) in the phase encode mode. Mask track is shifted from logical track 0 to track P. The test is performed in both the read status and write modes.
- o Data and block length are the same as Routine 32. In this routine, loop write read operation is performed 18 times (nine mask patterns by two status).
- o The routine also checks that the error track pointer is equal to masked track. VRC error is set in write status operation and is not set in read status operation. Confirms check functions in read circuit.

Routine 41: Group Coded Recording 1-Track Correction Test.

Error Codes:

- 41 00 Routine successfully completed with no errors.
- 41 XX Error detected.

General Description:

- o This routine is executed with the FMT in the loop write/read mode of operation with one tape track masked.
- o This routine confirms that the error correction function operates without error detection during write and read modes.

Routine 42: Group Coded Recording 2-Track Correction Test.

Error Codes:

- 42 00 Routine successfully completed with no errors.
- 42 XX Error detected.

General Description:

- o Mask pattern is shifted from logical track 0 and 1, 1 and 2, 2 and 3, ..., to 7 and P.
- o This routine confirms that the two-track correction function operates without error detection during read status and that a VRC error is detected in the write mode.

Routine 43: Group Coded Recording 3-Track Correction Test.

Error Codes:

- 43 00 Error detection circuit operates normally.
- 43 XX Error detected in the error detection function.

General Description:

- o This routine is executed with the FMT in the loop write/read mode of operation with three tape tracks masked.
- o The mask tracks are logical tracks 1, 4 and 6. This routine confirms the error detection function and that the pointer circuit operates normally.

Routine 44: Phase Error Pointer Test.

Error Codes:

- 44 00 The phase error pointer circuit in read printed circuit assembly functions normally.
- 44 XX Error detected in phase error pointer circuit.

General Description:

- o This routine exercises the issue phase error function in the phase encode and group coded recording loop write/read modes. The phase is inverted by force, which causes the phase error signal to be generated in the variable frequency oscillator (VFO) printed circuit assembly (PCA 1A04 in the FMT). The phase error track is one track and is shifted from track 0 to track P.

Routine 45: Nonreturn to Zero I Correction Test.

Error Codes:

- 45 00 Error track register and correction circuit functions normally.
- 45 XX Error detected.

General Description:

- o This routine is executed in the loop write/read, nonreturn to zero I mode. One track is masked and a data pattern (all "1's") is sent to the error track register (register for error correction). The masked track is then shifted from track 0 to P.

Routine 46: Format Control Circuit.

Error Codes:

- 46 00 Hardware counters that check the block format and format error detection circuit function normally.
- 46 XX Error detected.

Routine 46: Format Control Circuit. (Continued)

General Description:

- (1) Noise check (NOISC) signal. This test checks each bit for early-begin read-back errors. Using the loop write/read FMT function, the noise check signal is sent via detection of beginning of block signal. The timing is -20% of the time for read/write head gap length after onset of write. All tracks are masked for 80% of the read/write head gap length for onset of write.
- (2) Slip check signal. This test checks each bit for slow-begin read-back errors. This test is similar to the NOISC test except for timing. In this test, -20% is replaced by +7% of read/write head gap length.
- (3) Start read signal. Checks bits for preamble. All tracks written with all "1's" in the loop write/read mode. The routine confirms that the start-read check signal is set within fixed time.
- (4) End data check signal. Checks bits for postamble length error. When the postamble is detected in loop write/read mode, the write pattern is changed to all "1's". Writing continues while the routine confirms that the end data check signal is set within fixed time.

Routine 50: Reel Servo Test (Tape Turning Test).

Conditions:

- o A work tape should be used for this test.
- o This routine does not read or write the tape.
- o After completion of test, the other command operations are not affected.

Error Codes:

- | | | |
|----|----|--------------------------------------|
| 50 | 00 | Reel motor operation is confirmed. |
| 50 | 1X | Error detected during forward test. |
| 50 | 2X | Error detected during backward test. |
| 50 | XX | Error detected. |

General Description

- o Tape runs forward/backward for a few seconds.
- o Test with time delay and with tape running.
- o Test without time delay and with tape running.
- o Tests are applied with the following order:

(1) Run forward without stops	3 s
(2) Pause	100 ms
(3) Run backward without stops	2 s
(4) Pause	100 ms
(5) Run forward without stops	1 s

Routine 51: Reel Servo Margin Test.

Conditions:

- o A work tape should be used for this test.
- o This routine does not read or write the tape.
- o After completion of test, the other command operations are not affected.

Error Codes:

51 00 The reel and reel servo both function without error when subjected to servo-control worst-case conditions.

51 XX Error detected.

General Descriptions

Run time, pause time, and reel motion reverses are executed so that load is the maximum at reel motion, and forward turn/backward turn are performed.

Details:

Each test is done 10 times in the following order:

Speed Item	125 ips		75 ips		50 ips	
	Go up time (ms)	Go Down time (ms)	Go up time (ms)	Go down time (ms)	Go up time (ms)	Go down time (ms)
1. Forward run	80	80	50	50	20	20
2. Forward run	160	160	100	100	40	40
3. FWD/BWD run	160	160	100	100	40	40
4. FWD/BWD run	320	320	200	200	80	80
5. Backward run	160	160	100	100	40	40
6. Backward run	80	80	50	50	20	20

Routine 52: Capstan Simple Running Test.

Conditions:

- o A work tape longer than 50 meters is used for this test.
- o Data contained on the tape must be in continuous, normal format.

Error Codes:

52 00 The capstan motor functions normally without error.

52 XX Errors are detected when tack pulse, gap control, gap control signal, running direction, and running speed are checked.

General Description:

The tape runs forward for about 30 m at a constant speed, the tape then runs backward about 30 m at a constant speed.

Routine 52: Capstan Simple Running Test. (Continued)

Details:

The following items are checked for both forward/backward runs.

- o GAPC signal is on.
- o Handler action signal is on.
- o Tacho A signal is on.
- o Tape speed is constant.
- o Running direction is checked via the MTU handler backward signal and capstan forward signal of FMT.
- o Tape unit check indication is not asserted.

Routine 53: Write Current On Test.

Conditions:

- o A work tape must be used because write current is sent to the write head.
- o A tape having continuous scratches must be used.

Error Codes:

53 00 When current flows in the write amplifier, write current/erase current are normal and data is detected from the read head.

53 XX An error is detected.

General Description:

- o During writing in the phase encode mode, write current and erase current are normal. When all the tracks are written at 3200 FCI, the test checks whether the read signal of all the tracks is detected within about 15 m from beginning of tape.
- o When tape error (Error Code 05) is displayed, the tape must be changed to another tape, and the test must be repeated.
- o The Error Code 05 is normal because the tape itself has an error (this proves the error can be detected during write attempts). Next the tape is changed to a good tape to prove that there is no error in the hardware.

Routine 54: Autocleaner Test.

Conditions:

- o A work tape with gaps between the data is used for this routine.

Error Codes:

54 00 The autocleaner functions properly.

54 XX Error detected.

General Description:

All "1's" are written on Track 8 (about 4 inches) around beginning of tape in phase encode mode. The autocleaner is activated. Track 8 is read after rewinding the tape, and the data on at least 0.9 cm of tape is checked. This check is repeated five times.

Routine 55: Capstan Servo Margin Test (1600 bpi Write Test).

Conditions:

- o A full reel of good quality work tape is used. Data must contain gaps due to data write functions.
- o Routine 55 should be followed by Routine 56.

Error Codes:

55 00 No errors detected.

55 XX An error is detected.

General Description:

- o Five combinations of start/stop time are executed so that the load is the maximum at the capstan servo. Slippage and speed change are also checked.
- o All "1's" are written on all the tracks at 3200 fci. Inter-block gap (IBG) length is 0.6 inches. Postamble and preamble are not written.

Details:

- o Go tag signal is on. After the gap control signal is set, this test checks whether tape speed is steady at the start of writing in 0.6-inch IBG mode. If the tape speed is constant, velocity Retry Operation is executed. Errors are detected at Retry Out and excessive retries.
- o The intervals between start of writing and detection of read data are checked. Slippage is also checked.
- o Start/stop time and the number of blocks written are shown below. The blocks are written in the following order:

Item	Write block length (bit cell)	50 ips		75 ips		125 ips	
		Blocks	Go Down time (ms)	Blocks	Go down time (ms)	Blocks	Go down time (ms)
1.	300	64	10	128	6	256	4
2.	1100	64	10	128	6	256	4
3.	4300	64	10	128	6	256	4
4.	17100	64	10	128	6	256	4
5.	25500	32	10	32	6	32	4

Routine 56: Capstan Servo Margin Test (1600 rpi and Backward Read).

Conditions:

- o After completion of Routine 55, this routine should be issued without changing tape position so that all the blocks written at Routine 55 are used.

Error Codes:

56 00 No errors detected.

56 XX Error detected.

General Description:

- o Go down time of the blocks written during routine 55 is set to 10 ms at 50 ips, 6 ms at 75 ips, and 4 ms at 125 ips. When backward read is normal at all the blocks, forward read is then executed.
- o While data is being detected, this routine checks whether tape speed is within $\pm 7\%$ of the normal speed. During 29 tach pulses after detection of IBG, the "crease tape check" is executed.

Routine 57: Capstan Servo Margin Test (6250 BPI and Write).

Conditions:

All full reel of good quality work tape should be used. Data will contain gaps due to the nature of the test.

Error Codes:

57 00 No errors detected.

57 XX Error detected.

General Description:

MTU is in 6250 bpi mode and SAGC count is set to step 6. Read slice level is the same as that of normal write. At 9042 fci, all the tracks are written, but formatting is not done. IBG length is 0.3 inches. The same procedure as that for Routine 55 is followed, and capstan slippage and speed change are checked.

Details:

- o At the start of writing, this test checks whether the tape speed is constant. If tape speed is not constant, Velocity Retry Operation is executed. In case of retry out and excessive retry times, an error is detected.
- o Start/stop times are shown below. Tests are applied in the following order:

Routine 57: Capstan Servo Margin Test (6250 BPI and Write). (Continued)

Item	Write block length (bit cell)	50 ips		75 ips		125 ips	
		Blocks	Go Down time (ms)	Blocks	Go down time (ms)	Blocks	Go down time (ms)
1.	600	64	5	128	4	256	3
2.	2200	64	5	128	4	256	3
3.	8600	64	5	128	4	256	3
4.	34200	64	5	128	4	256	3
5.	51000	32	5	32	4	32	3

Routine 58: Capstan Servo Margin Test (6250 bpi Forward and Backward Test)

Conditions:

- o This routine should be run after Routine 57. This routine is executed without changing tape position so that all the blocks written in Routine 57 are used.

Error Codes:

58 00 No errors detected.

58 XX Error detected.

General Description:

- o Go down time of the blocks written in Routine 57 is set to 5 ms at 50 ips, 4 ms at 75 ips, and 3 ms at 125 ips. When backward read is normal at all the blocks, forward read is then be executed.
- o While data is being detected, this routine checks whether tape speed is within $\pm 7\%$. During 10 tach pulses after detection of IBG, "crease tape check" is executed.

Routine 60: Erase Test.

Conditions:

- o A good quality work tape should be used.

Error Codes:

60 00 No errors detected.

60 XX Error detected.

General Description:

The tape is rewound, and after running forward 10 inches from beginning of tape, all "1's" are written on all the tracks for 10 inches at 1700 bpi. After 8.6 inches of back space, the MTU is placed in the erase mode. While 8.6 inches are erased, data is read at a slice level of 7%. If data is not detected, the effects of erasing are checked.

Routine 61: Self Amplitude Gain Control Circuit Test.

Conditions:

- o Work tape should be used.
- o There should be no scratches longer than 15 cm on the tape within 15 m from the beginning of tape marker.

Error Codes:

- 61 00 No errors detected.
- 61 61 Error detected on the tape. The tape should be changed and tests repeated.
- 61 XX Error detected.

General Description:

- o The tape is rewound, and the MTU is set to the 6250 bpi mode. The SAGC count of step 6 and the read slice level of 51% is confirmed.
- o After spacing 10 inches from beginning of tape and writing on all the tracks at 9042 fci, the test program searches for a place where the time sense signals of all tracks are on. If not found within 150 mm, writing is stopped and the tape is backspaced 150 mm. At this position, the test is applied to SAGC circuit.

Details:

Tests are run with the following sequence:

- (1) All "1's" are written on all the tracks and SAGC operation is executed in the MTU. The routine then confirms that SAGC check error is not set.
- (2) The head is returned to the place specified in the general description. Using the forward read, the SAGC operation is executed in MTU. The routine confirms that SAGC check has not been set.
- (3) While tracks are masked and bits 7, 6, 5, 4, 3, 2, 1, 0, 8, are written at every track, SAGC operation is executed. The routine confirms that SAGC check error has not been set.
- (4) During writing on all the tracks masked, SAGC operation is executed. SAGC check error and step 12 of SAGC count is confirmed.
- (5) After SAGC check is found at step 12, the block write is executed. The gain step down operation is checked by the SAGC count, decreasing to step 11.

Routine 62: Group Coded Recording Normal Write Test.

Conditions:

- o A work tape should be used for this test.

Error Codes:

- 62 00 No errors detected.
- 62 22 Tape error. After changing the tape, repeat the test.
- 62 XX Errors detected.

General Description:

- o The SAGC is checked in a manner similar to Routine 61. After setting a SAGC count suitable for the tape, the tape will be verified. When an area of good quality is selected, 10 blocks are written.
- o Write data is random data. Block length is 55 bytes during online diagnostics (or Routine 00 of offline diagnostics), and 4k bytes during offline diagnostics.

Details:

- (1) Verification of the tape.
 - All "1's" are written at normal slice level. Tape is advanced 20 inches until time sense signals of all the tracks are on. A tape error is detected when a good area of 20 inches cannot be found within 60 m.
- (2) Write data.
 - o Random write data is generated by the microprogram. Write data is written in the transfer buffer byte-by-byte until the buffer is full.
 - Using the forward read, the SAGC operation is executed in MTU. The routine confirms that SAGC check has not been set.
 - o After the start of writing data, the data is read from the transfer buffer. The data is fed to the controller interface bi-directional data bus as well as to the write modulation circuit.
 - o During that time, the accepting data (RECV) signal is reset, and data is looped from driver to receiver and is written in the transfer buffer again.
- (3) Read-after-write check.
 - o This check also verifies whether or not "data check" is detected by the error-detection circuit.

Routine 63: Phase Encode Normal Write Test.

Conditions:

- o A work tape is used for this test.

Error Codes:

- 63 00 No errors detected.
- 63 XX Tape error is detected.
- 63 XX Errors detected.

General Description:

- o The tape is rewound, and the MTU is set to the 1600 bpi mode.
- o At normal slice level, the tape is verified so that no defect area in 40 inches of tape is found. Ten data blocks are written in the no-defect area, and no "check data" should be detected.
- o Creasing the data and block length is the same as in Routine 62.

Routine 65: Slice Margin and Read Level Test.

Error Codes:

- 65 00 No errors detected.
- 65 XX Tape error is detected.
- 65 XX Errors detected.

General Description:

The read slice level is changed 10%, 15%, 41%, 51%, and 64%. The routine then checks that the time sense signal of all tracks is on for 256 tacho pulse lengths at each slice level. This routine checks read amplifier gain adjustment and head wear.

Routine 66: Inter-Block Gap Length Test.

Error Codes:

- 66 00 No errors detected.
- 66 XX Error is detected during the IBG length check.

General Description:

This routine writes ten blocks in phase encode and group coded recording modes and measures IBG length by counting tacho pulses while continuous backward running for the ten blocks. The blocks are 256 tacho pulses in length. The generated IBG in this routine is not normal IBG. Rather, 218 QTP length (0.512 inches) in the phase encode mode, and 116 QTP length (0.275 inches) in the group code recording mode.

Routine 70: Feed-Through Test.

Error Codes:

70 00 No errors detected.

70 XX Errors detected.

General Description:

This routine writes 3200 fci data in the phase encode mode and then checks the read signal in low (7%) slice level. The time sense signal should not be detected in any track until the read head reaches actual data. The routine checks for 50-QTP length after the start of write.

Routine 71: Cross-Talk Test.

Error Codes:

71 00 No errors detected.

71 XX Errors detected.

General Description:

- o This routine writes all "1's" in the phase encode mode (1600 fci) on tracks 1, 3, 5, 7, and 9, and erases tracks 2, 4, 6, and 8.
- o While writing 2.4 inches of tape, the routine reads low slice level and checks the noise level.

Routine 73: Phase Encode Read and Write Test.

Error Codes:

73 00 The routine is successfully completed with no errors detected.

73 XX Errors detected.

General Description:

- o The tape is first rewind. After an ID burst in the 1600 bpi mode is written, 25 inches of tape is verified.
- o Commands are executed with the following order:
 - (1) Write tape mark 10 times
 - (2) Write 4k byte 1 time
 - (3) Back space file 9 times
 - (4) Forward space file 9 times
 - (5) Back space 9 times
 - (6) Write 4k byte 1 time
 - Write 2k byte 1 time
 - Write 1k byte 1 time
 - Write 512 byte 1 time
 - Write 256 byte 1 time
 - Write 128 byte 1 time
 - Write 64 byte 1 time
 - Write 32 byte 1 time
 - Write 16 byte 1 time

Routine 73: Phase Encode Read and Write Test. (continued)

- | | | |
|------|-----------------|----------|
| (7) | Write tape mark | 1 time |
| (8) | Read backward | 11 times |
| (9) | Read forward | 10 times |
| (10) | Back space | 5 times |
| (11) | Space | 5 times |
- o From the above execution of commands, this routine confirms that no unit check (data check and some problem with MTU) occurs.
 - o The basic routine is also confirmed, since each command is executed by the basic routine that is ordinarily used during function operation.
 - o Write byte is always 55 bytes during online diagnostics or execution of Routine 00.

Routine 74: Group Coded Recording Read and Write Test.

Conditions:

- o A good quality work tape should be used for this routine.

Error Codes:

- | | | |
|----|----|--|
| 74 | 00 | The routine is successfully completed with no errors detected. |
| 74 | XX | Error detected. |

General Description:

- o The tape is first rewound. After an ID burst in the 1600 bpi mode is written, 25 inches of tape is verified.

Routine 75: Nonreturn to Zero I Total Read and Write Test.

Conditions:

- o A good quality work tape should be used for this routine.
- o When this routine is issued to a dual density unit, the diagnostic routine will not be executed and the test will terminate with no error detected.

Error Codes:

- | | | |
|----|----|---|
| 75 | 00 | Normal end. (Test is by-passed in the dual density unit.) |
| 75 | XX | Error detected. |

General Description:

- o The tape is first rewound. After an ID burst in the 1600 bpi mode is written, 25 inches of tape is verified.
- o The commands specified in Routine 73 are executed.

Routine 79: Special Routine to Test Ready Status

Conditions:

- o This routine is executed when the error code is 99 99 during offline diagnostics.

Error Codes:

- 79 00 No errors are detected at the interface between MTU and FMT as a result of the test by Routine 79. The cause of error code 99 99 is an operator error.
- 79 XX An error is detected at the interface between the FMT and the MTU.

General Description:

This test checks whether the detected error is in the device select circuit of the FMT or in the MTU interface cable. This routine can be executed in MTU not-ready status. No other routines can be executed in MTU not-ready status.

Routine 80: Test Program for Installation Checkout of Azimuth and Capstan Alignment

Conditions:

- o A master skew tape (BM BV MT 351d) or equivalent is used during execution of this routine.
- o Do not rewind tapes by hand. Use Routine 96 to return the tape to beginning of tape.
- o Error free diagnostic Routines 10 through 59 are a prerequisite for this routine.

Error Codes:

- 80 00 No errors detected.
- 80 XX Errors detected.

General Description:

- o Mode: TD model is executed in 800 bpi. DD model is executed in 1600 bpi.
- o Forward read from beginning of tape.
- o If no errors are detected, the routine stops at beginning of tape.
- o If no errors are detected, the routine unloads.
- o If errors are detected, the tape stops at the error position. Start this routine again after azimuth alignment is complete.
- o Skew marginal function signals (TM 0 - 3) of FMT 800 bpi read printed circuit assembly (1A01 in the FMT) are changed by the microprogram so that quantity of skew in read data is measured.
- o On master skew tape, all "2's" are written at 800 bpi. Width of sampling the differentiated pulse is changed from 50% of the intervals to 13%. This routine confirms that the read pulses in all the tracks are correct in the specified area (at least 200 bits/cell).

Routine 80: Test Program for Installation Checkout of Azimuth and Capstan Alignment (continued)

- o If the quantity of skew is within 13% of the intervals, the test is terminated with no errors detected. If quantity of skew is more than 13%, the error code shows the percentage where the error appears.
- o When the percentage of intervals is from 50% to 21% in backward mode, and skew is not within 21%, errors detected are due to incorrect capstan alignment.

Routine 83: Checkout Program for Conversion of Read Amplifier.

Conditions:

- o A good quality master tape (SRM 3200 or equivalent) is used.
- o The test is executed only after cleaning the head and tape path.
- o Error-free diagnostic routines 10 through 59 are a prerequisite for this routine.

Error Codes:

83 00 No errors detected.

83 XX Errors detected.

General Description:

- o All "1's" are written from beginning of tape in 3200 fci. The MTU read slice level is set to 64%. The routine then checks that the time sense signal of all the tracks of 10 inches is on and that the slice level is set to 125%. This program checks that the time sense signal of all the tracks of 10 inches is off.
- o The MTU is set to the group coded recording mode and SAGC count is set to step 6. All "1's" are written by 9042 fci and the slice level is set to 41%. This routine then checks whether time sense signal of all the tracks of at least 10 inches is on.

Routine 90: Tape Retention Action.

Conditions:

- o The tape to be rewound is mounted and is set to ready.

Error Codes:

90 00 Tape retention action is ordered to MTU. MTU starts this action.

90 XX Though tape retention action is ordered to MTU, it is not executed or errors are detected before execution.

Routine 90: Tape Retention Action. (continued)

General Description:

When tape retention action is ordered by the FMT, a ready signal goes off (online signal is still on). At the stop position, autocleaner will start and space to end of tape in 200 ips. At the end of tape, the tape automatically rewinds. When beginning of tape is detected after rewinding, ready signal will be "1." The tape retention action is ordered by the FMT. When MTU goes into the ready status, busy signal will go off and the set diagnose commands end as soon as MTU ends this action, the SSC signal will be on.

Routine 91: Data Security Erase Rewind Utility.

Conditions:

- o This routine completely erases the tape from beginning of tape to end of tape.

Error Codes:

91 00 No errors detected.

91 XX Error detected.

General Description:

First, the tape is rewound, and the DSE command is then issued from the MTU. Detecting end of tape, the unit rewinds the tape. While this routine is executed, the FMT is busy until completion of the MTU operation.

Routine 92: Read Check to Tape Mark.

Conditions:

- o In dual density units, a tape written in 800 bpi should not be used.

Error Codes:

00 00 No errors detected.

XX YY YY (decimal) data checks were detected.

General Description:

This routine reads the tape during offline diagnostics and counts the number of data checks. The routine proceeds from the stop position to detect one tape mark block. The data check count is saved in register Add.(1E/1F). Register Add.YO(1E) contains the upper bytes.

Routine 93: Group Coded Recording Write Running Utility.

Conditions:

- o The tape used is a work tape.

Error Codes:

00 00 No errors detected.

XX YY YY (decimal) data checks were detected.

General Description:

The tape is rewound to beginning of tape, and 4k byte blocks are written to end of tape in the 6250 bpi mode. When a write error is detected, backspace is done automatically. Write is done after erase. The routine stops at detection of end of tape. Upper bytes of error count are saved in register YOAdd(1E). Lower bytes are saved in register YlAdd(1F).

Routine 94: Phase Encode Write Running Utility.

Conditions and Description:

- o Function is the same as Routine 93, except for writing in 1600 bpi.

Routine 95: Nonreturn to Zero I Write Running Utility.

Conditions and Description:

- o This routine cannot be used with a dual density unit. Function is similar to that of routine 93, except that writing is in 800 bpi.

Routine 96: Back Space to Beginning of Tape.

Conditions:

- o This routine returns the tape to beginning of tape. A master skew tape should not be used.

Error Codes:

96 00 No errors detected.

96 XX Error detected.

General Description:

The tape is returned to beginning of tape from the stop position at a constant speed. During execution, FMT is busy.

Routine 97: Space to End of Tape Utility.

Conditions:

- o When tests near the end of tape are necessary the tape can be advanced to end of tape by using this utility.

Error Codes:

- 97 00 The tape stops at the end of tape.
- 97 01 Manual interruption during execution is detected.
- 97 XX An error is detected during execution of this routine.

General Description:

The tape is advanced to the end of tape from the stop position.
The tape stops at the end of tape. FMT is busy until completion of this execution.